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INTESTINAL RESECTION; PRELIMINARY REPORT OF A SIMPLIFIED METHOD.

HOWARD LILIENTHAL, M.D.,
Attending Surgeon to Mount Sinai Hospital,
NEW YORK CITY.

For a number of years I have been treating the stump in appendicectomy by simple ligation and carbolic acid cauterization of the mucosa, a method which I first saw practised in the early nineties by Dr. W. F. Fluhrer. After a test of several years in some hundreds of cases, I published a paper on the subpect in the *Medical News,* November 28, 1903, and now after another five years, with abundant experience, I see no reason to change the favorable views I then held.

M. J. Seelig, of St. Louis, in an exhaustive study of this matter has demonstrated (*Annals of Surgery,* Vol. 40, p. 710), both by argument and by illustrations of microscopic sections, that the mucosa is crushed and crowded away from the ligature both proximally and distally, in such a manner as to seal effectually the undisinfected lumen of the organ.

On March 22, 1905, I performed a pylorectomy, making use of Maury's twine triangular stitch for the gastro-jejunostomy, and the patient's condition being such that speed had become a most important element, I treated the stump of the rather short duodenum by a simple ligation and carbolization. The Maury stitch did not cut through, so the stomach remained completely shut off and the patient died, with symptoms like those of uremia, eight days later. At autopsy there was no peritonitis and the duodenal stump looked perfectly healthy.

CASE I.—October 21, 1908, I operated on J. B., a man 46 years of age, who gave a history of symptoms indicating eight years of pyloric stenosis. Pylorectomy for chronic ulcer was done, the gastro-jejunostomy being accomplished by suture. The gastric stump—if I may call it so—was closed by double suture in the usual manner. The short duodenal stump was ligated with heavy silk, using great constricting force. The half-inch free stump of duodenum was well cauterized with 95% phenol, and the long ends of the ligature left in the upper angle of the abdominal wound alongside of a small cigarette drain.

Healing was ideal, the ligature coming away on the nineteenth day, and the patient was discharged with wound completely healed twenty-one days after operation.

CASE II.—This patient, a woman of 43, was operated upon by the same technic, and was exhibited at a stated clinical conference at the Mt. Sinai Hospital on December 17, 1908, twenty-one days after operation. Convalescence had been ideal but the ligature had not yet come away, though the remainder of the wound was soundly healed and the patient had been up and about for some days and was enjoying the usual hospital diet. The specimen proved to be an indurated ulcer with cancerous degeneration. The ligature came away in seven weeks and the sinus at once closed.

CASE III.—On November 18, 1908, a woman 72 years old, entered the hospital in the last stages of intestinal obstruction. Section with the aid of local anesthesia revealed hernia through a hole in the omentum, a loop of about eighteen inches of ileum being strangulated and its mesentery thrombosed so that repeated incisions across the vessels were not followed by hemorrhage. There was distension, and the abdomen was filled with bloody serum. Resection of about thirty inches of intestine was performed, the stoma being side-to-side, in the direction of normal peristalsis, and the ends treated by ligation and carbolization instead of invagination and suture. Death occurred in about twelve hours. The post-mortem examination showed neither leakage nor septic reaction at the stump.

CASE IV.—B. S., a man 22 years of age was operated upon December 17, 1908, for tumor of the ileo-cecal region. The mass was movable and the size of a fist. Numerous glands in mesentery. The root of the apendix was implicated, but the greater part of the tumor was in the cecal wall and there was considerable narrowing of ileo-cecal orifice. The method was used here in large and small intestine, the stoma being made side-to-side between

the ileum and the first part of the transverse colon. The ends of the strings were left out of the wound and a small short drain was inserted through the peritoneum. Convalescence was absolutely without constitutional reaction. Five days after operation the first dressing was changed. The drain was removed and was followed by about two drachms of pus. Two days later there was nothing left but a slightly discharging sinus, the ligatures being cast off twelve days after operation.

In this case the operation by any other method would have been quite difficult. End-to-end anastomosis, especially, would have been hard to perform owing to an exceptionally thick mesocolon which would have made trouble at the mesenteric border of the anastomosis. By this new method the operation was extremely rapid and simple.

CASE V.—December 25, 1908, a woman, 35 years old, had had increasing signs of intestinal obstruc-

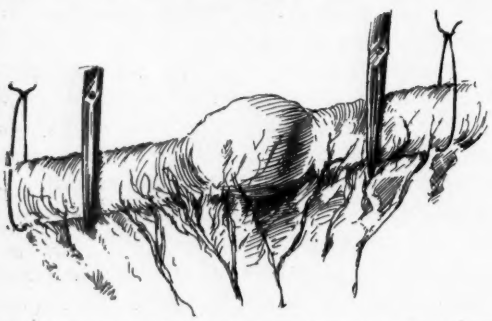

Fig. 1. Clamps and Ligatures in Place, Knots Not Yet Tightened.

tion for four days, with distension, visible coils of intestine, rapid pulse and fecal vomiting. On admission to the hospital her condition was extremely poor and immediate operation had to be performed.

On careful examination in anesthesia, Dr. Moschcowitz, who happened to be present, discovered a very slight fulness in the region of the right femoral ring. Reasoning that we were probably dealing with strangulation of the femoral hernia, a right lower quadrant abdominal section was made between the fibers of the rectus, and a coil of ileum was found adherent to the internal orifice of the femoral canal. A second incision over the hernia revealed a sac containing foul bloody fluid. By combined manipulation, the intestine was freed and drawn into the abdominal cavity. It proved to be a Littré's hernia with complete gangrene of all the walls of the intestine. There was a considerable amount of free fluid in the abdominal cavity. The patient's condition was very poor and we had to work quickly. Resection was performed after the method described, one of the ligatures being cut short and dropped back into the abdomen, while the other was drawn through the femoral canal alongside of a cigarette drain which led down to the anastomosis. The abdominal wound was completely closed by suture. Infection of the wounds took

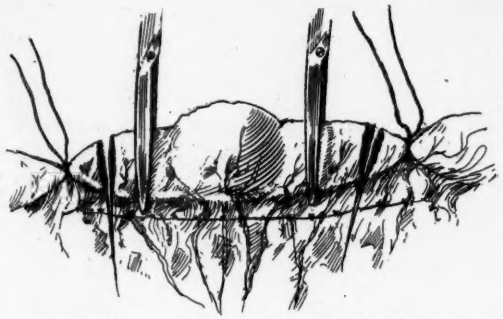

Fig. 2. Knots Tightened and Resection Made.

place, as might have been expected in the presence of gangrenous infection, and in addition right-sided pneumonia complicated the convalescence. After the first twenty-four hours, however, the patient was at no time in a critical condition. The ligature was discharged on the tenth day, and with it came the little free funnel of intestine. The other ligature was never "heard from."

CASE VI.—M. P., a man about 40 years of age, had been operated upon twice for bleeding from the rectum, which, we believed, originated in the upper portion of his intestinal tract. At the first operation, about two and one-half years ago, the gallbladder was found adherent to an ulcer of the duodenum near the pylorus. It was free and a pyloroplasty performed. About a year later, on account of further hemorrhages, gastro-jejunostomy was done. In January, 1909, he entered the service of Dr. Rudisch at Mt. Sinai Hospital, almost exsan-

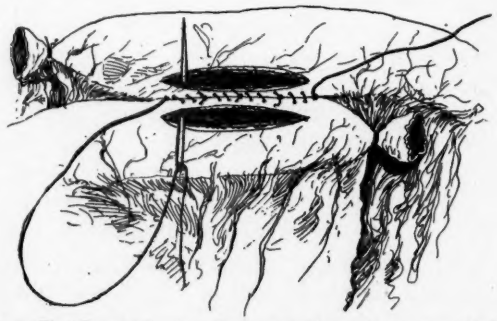

Fig. 3. First Row of Lembert Sutures Tied. Stonia Openings Made. First Through and Through Suture Being Inserted.

guinated from the loss of blood by rectum, his hemoglobin having reached the low point of 18%. Operation at this time seemed to offer too great a risk, so, at my request, transfusion of blood was

performed by Dr. Elsberg, on January 21, 1909, and the hemoglobin percentage was raised to 47. Thinking that the blood had come from the pyloric region of the duodenum, and there being no method to my knowledge by which the exact location of the ulcer could have been determined, I performed a pylorectomy the following day, closing the duodenal stump by ligature. I noted that the gastro-jejunostomy opening was rather small, barely admitting the tip of the finger, and that probably in consequence of some narrowing of the intestine at this point the duodenum had become tremendously dilated. Thinking that the patient's condition would not permit of another gastro-enterostomy, and that the original one would prove sufficient for the passage of fluids, nothing except pylorectomy was done. Two days after the operation, there was profuse leakage of duodenal fluid, mostly clear, probably pancreatic. The patient continued to have tarry stools. I believed, and still believe, that on account of the haste which appeared necessary

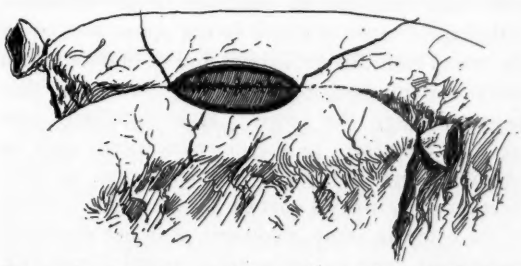

Fig. 4. Completed Row of Sutures, Through Entire Wall of Gut.

at the time of the pylorectomy, the ligature needle invaded the wall of the duodenum, and that the silk in consequence did not completely encircle the intestine, but probably passed through the duodenal wall. There was considerable vomiting. Twelve days after the operation I once more opened the abdomen and made a quick and ample gastro-enterostomy, distal to the first one. The patient, however, continued to lose fluid through the duodenal leak and his condition became rapidly worse. On February 8th, Dr. Elsberg freed the duodenum, closed it by suture and fastened it down to the surface of the liver, thus stopping the leak. Two days later, however, the patient died.

Post-mortem examination by Dr. Libman showed recent peritonitis with the presence of bile in the abdominal cavity. There had been no peritonitis at the time of the second gastro-enterostomy. There was also a jejunal ulcer opposite the original gastro-intestinal stoma, which was probably the cause of the hemorrhages.

While this case is reported as a failure of the ligature, still I feel that the failure was not due to the method but to faulty technic which permitted the wall of the intestine to be invaded, perhaps even pierced by the ligature passer.

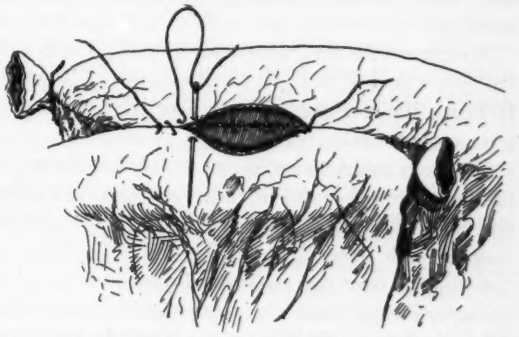

Fig. 5. Third Row of Sutures Being Inserted, Continuous With Those in Fig. 4 Through Entire Wall.

It would be unwise, without much further experience, to recommend the operation here described as a routine procedure in cases in which speed is not important. One can but feel, however, that a ligature of this sort is much safer in preventing leakage than any suture can be, and that lateral intestinal anastomosis is safer than end-to-end, because of the danger of leakage at the mesenteric border. It is well known that sutures will tear out under the stress of continued distension; a ligature obviously cannot give way until the stump is ready to be cast off. By this time (8 to 14 days after the operation), firm adhesion should have taken place.

The method will probably prove most satisfactory in dealing with resections of small intestine for

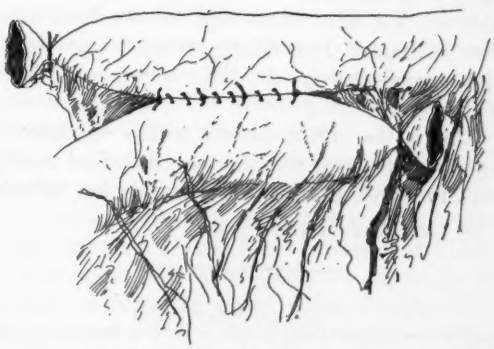

Fig. 6. Anastomosis Completed, Showing Final Row of Lembert Sutures.

acute destructive processes, such as gangrene of the gut. It will, perhaps, prove less satisfactory in dealing with the duodenal stump in pylorectomy, for the reason that we have such a large portion of the visceral wall not covered by peritoneum.

With the exception of Case III, an old woman already moribund, and Case VI, in which I believe there was a technical error, all the patients operated upon by this method have shown a remarkable freedom from shock, with rapid and uneventful recovery.

To those who may apply the method, I will give but one warning, viz., tie the ligature tight enough to crush the mucosa, and sterilize the stump with pure carbolic acid, not followed by alcohol.

This communication is, as its title indicates, a preliminary one, and certain changes of technic and modifications of the application of the method may become necessary. Then, too, it will be interesting to note the anatomical appearances of an anastomosis of this kind considerable time after the operation. For this purpose it will be necessary to make animal experiments. Dr. S. Wyllis Bandler has operated upon a number of dogs by this method and is at present engaged in a study of his cases. I regret to say that the work is not yet ready for publication, although of five dogs experimented upon, all made operative recoveries. The work was started rather late so that the time for examination of the specimens has not yet arrived. Then, too, it must be remembered that intestinal work in dogs is very misleading on account of the extreme resisting power of these animals for operations on the gastro-intestinal tract. Pigs would undoubtedly be much better for this class of experimental surgery.

After the completion of this paper, I found an article by Wölfler and Schloffer in Kocher's Encyklopädie der Gesamten Chirurgie, edition of 1903, p. 87, in which under the Billroth operation of pylorectomy, it is stated that the duodenal stump may be treated by crushing with a clamp, ligation and thermo-cautery, the little stump being buried with a purse-string suture.

This is the only reference to any operation remotely resembling the one here described which a cursory glance through the literature has afforded.

115 EAST SEVENTY-THIRD STREET.

"MIXED NARCOSIS."

When giving ether or chloroform alone most of the reflexes must be abolished in order to maintain the proper degree of anesthesia necessary for the successful issue of the operation. When morphin is administered these reflexes can be allowed to remain, and yet the patient will be perfectly quiet.—JAMES T. GWATHMEY in the *J. A. M. A.*

SIGMOIDITIS AND PERISIGMOIDITIS.*

JAMES P. TUTTLE, M.D.

NEW YORK CITY.

The fact that each portion of the digestive tract has a distinct anatomical conformation indicates for each a distinct physiological function; and we may infer from this that they may each be attacked by special diseases, or that the same pathological process will produce different effects in the separate divisions. Pathologically an inflammation, ulceration, or neoplasm may be the same whatever portion is attacked, but clinically they are very different. It is necessary, therefore, to study each part separately. The physiological and anatomical conformations and relations of the sigmoid flexure render it predisposed to all diseases arising from the intestinal tract, and also to those arising from other pelvic organs. Being the true fecal reservoir, and retaining as it does the fecal matter, longer than any other portion of the intestinal tract, it is practically subject to infection from whatever pathological cause is active in the upper portion of the tract, and also to injury and irritation from every foreign body, or irritating substance that passes through the bowel. It is peculiarly susceptible, therefore, to specific ulcerations, such as typhoid, tubercular, and dysenteric; but as such ulceration is always a part of a general involvement of the colon in these conditions, it is not necessary to consider them as producing a typical sigmoiditis, and we shall not discuss them at the present time. Occasionally one sees localized tubercular ulceration of the sigmoid; but this is very rare, and presents no symptoms different from other ulcerations. The writer has frequently seen dysenteric ulcers of the rectum and lower loops of the sigmoid with the upper part of the latter organ perfectly healthy. These belong to the type of rectal dysentery in which the disease has extended upwards. What I wish to call attention to at present is the broad subject of inflammation in and around the sigmoid flexure, viz:

SIGMOIDITIS AND PERISIGMOIDITIS

The term sigmoiditis was first employed by Mayor, of Geneva, in 1893; but the condition itself was first described as an entity by our own noted citizen, Dr. Joseph M. Mathews, of Louisville, Ky., *(Diseases of the Rectum, Anus and Sigmoid Flexure,* 1892).

Trastour, in a most instructive article on "passive dilatation of the sigmoid," describes most accurately

* Read before the Dutchess County Medical Society, January 8, 1909.

the symptoms of an acute type, but does not limit the condition to the sigmoid flexure.

Carpenter, in 1898, used the term frequently, but only to describe the acute and chronic catarrhal types of the disease. We are indebted to the French and German writers, chiefly Catz, Patel, Regnier, Edlephsen, Lejars, Walcha, and Bergman, for our literature upon the clinical aspect of the subject. Recently Byron Robinson, of Chicago, has published *(Medical Standard,* August, 1907, etc.), most elaborate and instructive anatomical and pathological studies of the sigmoid, and its relations. These articles are all well worthy of study, and I am indebted to them for much of my information on the subject. Especially am I indebted to Dr. Robinson's post mortem studies for the explanation of clinical phenomena. Elaborate classifications have been made by these writers, and interesting cases reported to support them; but it will simplify matters to adopt the following classification:

Sigmoiditis: catarrhal, ulcerative, and interstitial.

Perisigmoiditis: primary and secondary.

CATARRHAL SIGMOIDITIS.

Catarrhal sigmoiditis appears in both acute and chronic forms. The acute form has very little to distinguish it from ordinary catarrhal enteritis, involving more or less of the entire colon. It attacks this portion more frequently than others simply because the irritating substances remain in the sigmoid longer than they do elsewhere. It comes on suddenly, with more or less griping pain; some solid, hard or lumpy stools, followed by watery passages, then mucous, with or without blood; usually there is a slight elevation of temperature; generally it follows a period of constipation, or one of irregular diet; there is lack of appetite, but rarely nausea, and scarcely any burning pain in the rectum; there is flatulence, tympanitis over the general abdomen, but flatness and pain over the left iliac region. The condition usually subsides after a saline laxative and restricted diet, and leaves no sequela of importance. Such cases are rarely ever submitted to local examination, and therefore, we have few reports of the proctoscopic appearance. The following case, however, may be taken as a typical example:

Mr. M. (under my care for pruritis), while on a vacation became constipated for two or three days. To overcome this he ate heartily of fruit and took a pill of aloes. The next day he was seized with a severe pain in the lower abdomen, especially on the left side. Bowels moved freely, first hard lumpy stools, then watery; the next day he had seven or eight movements of almost pure mucus, with flecks of blood. Upon examination, October 10, 1906, temperature 99.2°; pulse, 80; tongue rough; tenderness over left iliac and suprapubic region; percussion slightly tympanitic; anus tender to touch, but not abraded; the rectum was normal except for a little glary mucus at its lower segment. The mucous membrane of the sigmoid flexure at its junction with the rectum showed increased redness, while that higher up was fiery red, and covered in spots with a sort of grayish sprue-like deposit in a bed of mucus; while parts were redder than others and swollen, the rugae being obliterated, I was unable to make out any ulcerations. Stool examination showed no amebae or bacilli dysenteriæ. The sigmoid was flushed with saline twice a day, a small quantity of a silver salt was instilled through the sigmoidoscope once a day. In four days the mucous membrane assumed its normal appearance, and the symptoms disappeared, except for the tenderness over the left iliac region, which persisted for about a week.

At times the attacks of this disease are more severe. The patient, after a period of unusual constipation is seized with pain in the left iliac region. This pain, in my experience, is more often a dull aching weight extending through to the back, than the acute agony such as is described by the French writers; the tongue becomes coated and red upon the tip and edges; the complexion becomes muddy; the pulse slightly rapid; there may, or may not be an elevation of the temperature; mental activity is very slow; the patient is inclined to sleep, or at least to rest in a reclining posture; palpation elicits a tenseness of the left rectus muscle; usually a thickening or a tumor in the left iliac fossa, with more or less tenderness on deep pressure. Rectal examination usually shows a *ballooned rectum,* without fecal contents; but to the front, and to one side or the other, one may feel a bosselated swelling, which, if one is not familiar with it, gives the impression of a neoplasm up above. The proctoscope, in such cases, usually demonstrates an acute flexure or angulation of the sigmoid upon the rectum, or between two of its own loops, above which has been arrested a mass of dry, sticky fecal matter. Such cases may be operated on for tumor of the ovary or broad ligament; while a large, overloaded and inflated sigmoid is the true cause of the patient's inconvenience. It is this fact that caused Segond to warn surgeons against too hastily applying the bistoury to swellings in the left inguinal fossa. The cause of all these conditions is the arrest, in the sigmoid, of irritating, putrid, infectious fecal matter. The longer such material remains the drier it becomes and the more irritating. These

patients may even have frequent movements of spurious diarrhea, the current passing around or through a channel in the center of the inspissated mass. The only way to diagnose them accurately is by local examination, with the pneumatic sigmoidoscope. It is easy to understand how such a condition as this may lead to the ulcerative type of sigmoiditis; or how, recurring from time to time, it may lead to a chronic catarrhal condition, with hypertrophy of the cells, plastic exudation in the walls themselves, and eventual contraction of its caliber. The treatment of all these acute types consists in cleaning out the bowel, better with irrigation than with too strong cathartics; limitation of food; ice poultices and rest in bed. I would call attention here to the good effects of peroxide of hydrogen in dissolving and dislocating these fecal masses. If there is blood, mucus and pus in the stools, astringent and antiseptic applications should be made to the parts, either through the sigmoidoscope or a Wales bougie. The attack usually subsides without sequelæ; but may drift into a chronic catarrhal, or even interstitial sigmoiditis, if proper rest, diet, and thorough cleaning of the bowel are not maintained.

CHRONIC CATARRHAL SIGMOIDITIS.

As has been stated, chronic catarrhal sigmoiditis may result from a recurrent acute condition; it may be part of a general catarrhal condition, or it may come on in an insidious manner. The patient is always constipated; he may have one or more thin stools a day, but these stools are accompanied by little hard lumps, surrounded by mucus; many such lumps are left in the sacules or flexures of the sigmoid. In some cases the fluid simply forces a channel through a solid fecal mass in the sigmoid, and, though stools are frequent, there is still impaction in the left iliac and suprapubic region; more or less dulness on percussion of this area; loss of relish for food; palpitation of the heart; the complexion is muddy, sometimes almost jaundiced; there is tired feeling; mental weariness; often periodical discharge of mucus, with or without the crisis of mucous colic. The mental and nervous symptoms accompanying, if not due to this condition, have been well described by Trastour, who believes that it is the preponderating cause in melancholia. I have seen a mild type of the latter in many cases, with persistent fecal stasis, and in two cases have seen acute mania, with delusions or hallucinations subside after the removal of the fecal accumulation from the sigmoid. Some of my readers may be familiar with the following cases, taken from my book on Diseases of the Anus, Rectum and Pelvic Colon.

Mr. A. T., lawyer, patient of Dr. Frederick Peterson, had been suffering from delusions, hallucinations, and partial unconsciousness for several weeks without any apparent cerebral disease to account for the same. His attack had begun in a diarrhea with severe pains and tenesmus, which continued more or less persistently except when he was under the influence of opiates. This pain was at first referred to the lower portion of the abdomen and rectum. An examination with the pneumatic proctoscope established the presence of an impacted fecal mass in the sigmoid flexure, together with a small ulceration at the juncture of the rectum with the sigmoid. The fecal mass was loosened and removed by the use of solutions of ox-gall and oil, together with pneumatic distention of the bowel. Within a few days the patient's mental condition cleared up and he became perfectly rational.

In these cases the proctoscope shows a pale mucous membrane; the sigmoid flexure is more or less dilated; it is sacculated, and may or may not be acutely flexed. The sigmoid is either blocked with a large fecal mass; or in the saccules and behind the flexures small masses of fecal matter are found coated with mucus or muco-pus. Frequently one finds small ulcers, due to traumatism or pressure of these small, hard fecal masses.

These are the cases which we all know as mucous or membranous colitis. They may have other initial causes; such as gall-stones, adhesions, chronic appendicitis, etc., but they all act through the production of fecal stasis, irritation of the mucous membrane, infection and toxemia, not always but generally in the sigmoid. They also frequently result in perisigmoiditis or mesosigmoiditis (including diverticulitis)—suppurative or non-suppurative, according to the type of infection. The treatment consists in removing the cause of the fecal stasis, and then caring for the catarrhal affections.

CHRONIC INTERSTITIAL SIGMOIDITIS.

While it appears that the fecal mass is the sole cause of the tumors or swelling in these cases, it has been observed that the latter do not disappear entirely when the bowels have been emptied; there nearly always remains a thickening, a small sausage shaped swelling in the left inguinal region, which can be easily felt, and which persists for weeks and even months after an inflammation of this kind; it gradually disappears, however, and usually the patient suffers no more from constipation after an attack than previously; the attacks recur, however. Aporti speaks of this type of recurring sigmoiditis,

and has observed one case through three separate attacks. There results a thickening of the walls after these attacks, a loss of suppleness, and a distinct infiltration. It has been described by Catz as a *Chronic Perisigmoiditis.* It is, in fact, an interstitial inflammatory sigmoiditis, without pus and yet almost cicatricial; as Catz says, it may follow an acute sigmoiditis, but more often develops obscurely in the form of chronic obstipation, with symptoms of autointoxication. There is always difficulty in defecation; the fecal masses are oval or flat, and may contain more or less pus and blood; the blood is black and mixed with fecal matter as a rule, but sometimes it is bright red; there is a dull pain in the iliac region, which is increased upon the passage of gas or fecal matter; there is more or less inflammation of the serous covering of the bowel, and to this, as well as to toxic absorption, is attributed the rise of temperature, the frequent pulse, and all the symptoms of peritoneal inflammation. The sausage shaped tumor may be felt in the left iliac, or it may rise to any portion of the abdominal cavity; as a rule it is fixed, and is sometimes slightly nodular on its surface. The nodules have been shown to be small diverticulæ, or hernias of the mucous membrane through the muscular coating of the bowel, usually extending into the appendices epiploicæ. It is easy to see how such a condition may be taken for cancer of the sigmoid. The proctoscope shows little or no ulceration, but a stiff, more or less contracted sigmoid, painful upon pressure, and not dilating, either to atmospheric or artificial pressure; there is no granulation or cauliflower-like protrusion into the caliber of the gut, which would suggest adenocarcinoma, nor is there such cicatricial tissue as would indicate specific stricture; at the same time, there is nothing to prove that such cases are not scirrhous, and operation is the only means of absolute diagnosis.

As to the treatment of this type one can say very little if it be not surgical. If one could say positively that it was not malignant, palliative and absorbent treatment would be justified; but when such a serious question is in doubt one cannot waste valuable time with this. The abdomen should be explored at once to learn the nature of the tumor. This done, the condition of the parts will decide whether the diseased area should be excised or an artificial anus made with the view of giving physiological rest.

PERISIGMOIDITIS: DIVERTICULITIS.

Perisigmoiditis, as the name would indicate, consists of an inflammation around the sigmoid, which may be primary or secondary, suppurating or non-suppurating.

Primary Perisigmoiditis: This type has its origin in the sigmoid itself; it may result from ulcerations, simple or specific, extending through and perforating the wall of the gut; from traumatism or puncture by foreign bodies; from *diverticulae* which become inflamed through the long arrest and pressure of fecal matter in their cavities, their mouths becoming closed through edema of the mucous membrane. Byron Robinson, who has done such excellent work in the anatomical studies of these conditions, believes that the inflammation in these cases is due to traumatism from the iliac and psoas muscles, upon which the gut often lies; he says that under strong exercise they pound or squeeze the gut wall against the hard fecal mass within, and thus set up irritation of both the peritoneal and mucous surfaces. If these become infected, we have suppurating sigmoiditis, if not, non-suppurating. I attach much importance to this theory, for I have seen the condition follow both horseback and bicycle riding. The inflammation may confine itself to the peritoneum covering the gut and its mesentery, or it may cause adhesions to other organs, thus limiting the mobility of the sigmoid and restricting its peristaltic action. The condition may remain simply inflammatory and adhesive, or it may progress to suppuration. Where no infection occurs the condition resolves itself into a simple localized peritonitis, with pain, rapid pulse, elevation of temperature, etc., all subsiding under physical and physiological rest; but if infection and suppuration take place, we have to deal with suppurating perisigmoiditis, often taken for left sided appendicitis, for they resemble in every way attacks of appendicitis or perityphlitis, only they are upon the left side. Brewer recently reported six cases. (*Journal American Medical Association,* October, 1907) of abscesses occurring upon the left side, and which he believed at first were left sided appendicitis, due to transposition of the viscera; after more careful observation, however, he concluded that they were all probably due to *diverticula* of the sigmoid flexure. Sidney Jones (*Transaction of the Pathological Society,* London, 1858), Loomis (*Transaction Pathological Society,* New York, 1877), Patel, Catz, Eiselberg, and others have reported like cases. Walcha reports a case due to lumbricoid worms; and Bland Sutton to whisps of hay in the appendices epiploicæ. The irritation in all these cases is supposed to extend from the mucous membrane to the peritoneum by direct extension or by the appendices. Graser believes it is due entirely to infection of the

mesosigmoid through the diverticula. While this view is not tenable, seeing the abscesses have been found on all surfaces of the gut, it is a fact that most of the perforations of diverticula take place in parts of the intestine covered by cellular tissue, such as the mesosigmoid or epiploicæ. In cases which have been opened the tumor has invariably been found to be of inflammatory nature in the mesosigmoid and due to leakage from the gut through minute diverticulæ. The one thing upon which all agree is present or previous obstipation and fecal stasis in the sigmoid.

Primary suppurating perisigmoiditis comes on as an acute sigmoiditis; there may or may not be a chill; there is tension of the right rectus muscle; constipation; nausea; there may or may not be vomiting; tumor is present in the left iliac, or it may be as high as the umbilicus, it soon becomes fixed; sometimes it may be resonant, owing to the presence of the gut between the abscess and the abdominal wall; sometimes it may be dull all over the suprapubic region, but usually it occupies the left iliac fossa or lumbar region; the temperature may go very high, and the pulse become very rapid. Leucocytosis is present, but it does not always mean pus, as it often occurs as the result of intestinal putrefaction; the countenance is anxious; digital rectal examination reveals nothing; and while the sigmoidoscope showed inflammation and edema over the involved area, in the cases we have observed, the information was of no practical value in the presence of so many evidences of intraabdominal abscesses. It is said by Catz that these abscesses may be absorbed. Personally, I have observed only one that has followed this course. In this one the tumor of the mesosigmoid remained until it was removed after a second acute attack six years later. The old inflammatory focus was apparent. It is possible that they may be encapsulated for long periods; but eventually as a rule they open, either into the gut, upon the skin, or into the peritoneal cavity. I have seen two cases in which the abscess opened, refilled, and opened again into the sigmoid flexure, and the patients seemed to enjoy a fair degree of health excepting at the time when the abscesses were not discharging freely. In one case I was able to insert a probe into the abscess cavity in the mesosigmoid through a sigmoidoscope. These patients would not submit to operation, and I must confess I did not urge it, as I questioned whether it might not result less favorably than the spontaneous openings. Cases in which the abscesses have been evacuated upon the skin surface have nearly all done well. Those which open into the peritoneum all prove fatal. Two or three cases have been reported in which the diverticulæ have attached themselves and opened into the bladder, causing an enterovesicular fistula. I have never seen one of these cases, nor do I know the eventual outcome of such complications.

The treatment of these cases depends entirely on whether or not the presence of pus has been established. I have only recently seen a case in which there was a tumor in the left iliac fossa, as large as an orange and very hard, coming on after an operation on a uterine adhesion and confinement of the bowels for six days. The operating surgeon thought he had to do with a hematoma, or a non-septic abscess. Local applications to the inguinal region, thorough cleansing of the sigmoid by enemeta and rest in bed caused its entire disappearance within two weeks without operation. I say entire disappearance, there still remains a slight thickening in the tissues and immobility of the sigmoid at the point of this plastic deposit. This emphasizes Segond's axiom, already stated, that one should never be in a hurry to open a swelling on the left side. On the other hand, one should not interpret the axiom too literally and take the chance of an abscess bursting into the peritoneal cavity, in the face of such evidences of pus, as chills, elevated temperature, night sweats, sweetish breath, leucocytosis, etc., but should open the abdomen with great care and evacuate the pus if present. The advice to wait until the peritoneal cavity is sealed and the opening can be made through the adherent point is most misleading; if the abscess is in the mesosigmoid, the probabilities are it will never become attached to the wall, and one will always have to pass through the free peritoneal cavity to reach it; even when the abscesses are well outside of the pelvic cavity and up in the abdomen they are seldom adherent to the anterior peritoneum.

When pus is not established the use of ice, followed by creoline poultices, rest in bed, gentle catharsis, and a limited but mixed diet, is the proper course to follow.

Secondary Perisigmoiditis: The sigmoid, through its location in the pelvis, and its ability to rise up and extend into all parts of the abdominal cavity, is subject to inflammation by extension, from almost every abdominal and pelvic organ.

Byron Robinson has shown from seven hundred autopsies that the appendix lies in the pelvis in 48 per cent. of women and 38 per cent. of men; the sigmoid in 75 per cent. of women and 65 per cent.

of men (*The Medical Standard*, 1907, page 357). The intimate anatomical relation of the two organs renders it probable that when one is inflamed the other is likely to be involved in the same process by extension. If such is the case with regard to the appendix how much more so is it true with regard to the reproductive organs in females. The fimbriated extremities of the tubes, the ovaries and the uterus are in constant touch with the sigmoid flexure; and what inflames one organ is almost certain to involve the other in adhesions and in inflammatory exudation.

Abscesses of the ovary or tubes, whether gonorrheic or simple, have been known many times not only to adhere to the sigmoid, but to rupture into this organ. Robinson, in his most excellent paper on "The Relations of the Sigmoid to the Pelvic Organs," reports a case of a young woman with three separate openings into the sigmoid, from a tubular abscess; he says that many deaths are caused in laparotomy by reopening these fistulous tracts and not closing the opening into the sigmoid. He urges careful examination of the sigmoid after all abdominal operations, and says, "I know of no abdominal organ, except the pancreas, to which I have not found the sigmoid adherent." Personally, I have detached the sigmoid from every abdominal organ except the pancreas and liver; and I have had, time and again, to suture tears in the sigmoid after removing adhesions originating sometimes in the sigmoid and sometimes in the other pelvic organs. The chief point of interest in this part of my paper is the fact that we do have many cases of acute and chronic perisigmoiditis, both non-suppurative and suppurative, which resemble, in a large measure, appendicitis on the left side or inflammation of the pelvic organs. These conditions should be carefully distinguished from one another; too great haste in opening a tumor on the left side may result in opening into a passively distended sigmoid, or into an interstitial sigmoiditis. The fact that the tumor is on the right side, or high up in the abdomen does not preclude its sigmoidal origin, for it is the function of the sigmoid to rise into the abdomen whenever it is distended by feces or gas, and it is just this condition that invites inflammation, adhesions and suppuration at whatever site it may occupy. Finally, the history of such attacks of sigmoiditis should always put one on his guard against recurring volvulus, for it has been shown very clearly that these inflammations shorten the mesentery and predispose the patient to acute flexures, angulations or twistings of the gut, which demand the most prompt and radical interference.

SACRAL SUSPENSION OF THE UTERUS—A NEW TECHNIC.

JOHN VAN DOREN YOUNG, M.D.,
NEW YORK CITY.

In an article read before the New York Obstetrical Society in May, 1903, and published in the *Medical Record*, October 24, 1903, I called attention to the importance of the utero-sacral ligaments in the support of the uterus. Experience since that time has served to strengthen my opinion as to their value as factors in the general scheme of uterine support. To comprehend the importance of these ligaments you must appreciate that they come into play when the body is in the upright position, and also remember the anatomical relation between the sacral vertebrae and the posterior

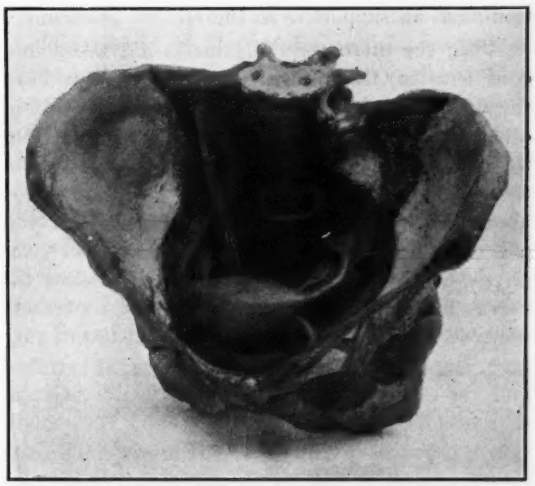

Figure 1.—Showing Normal Relations of Utero-sacral Ligaments and Relation of Ureter. Uterus Pulled Well Forward and Upward.

surface of the uterine body; bearing these points in mind it is easy to realize that in the standing position, the utero-sacral ligaments are practically the only ligaments supporting, or, perhaps, better, hanging the uterus in its normal position. It is also well to remember that in the standing position the patient most needs uterine support. The utero-sacral ligaments may be compared to the ropes of an ordinary swing. These ligaments are attached to the under surface of the sacrum and, spreading fan-like, are adherent to the outer portion of the anterior surface of the first and second sacral vertebrae. The segment of the uterus at the corporo-cervical junction forms the board or seat of the swing. Between the ropes of this swing the rectum passes. If this mental picture carries any comprehension to the reader's mind of the conditions existing, he will

notice that the balance between the weight above and below, or better, in front and behind of the utero-sacral swing, is very much in favor of the fundus. Added to the forward tilt of the fundus, are the guy ropes in the form of the round ligaments, the chief action of which is to keep the fundus forward at all times.

Analyzing the action of the various ligaments which attach the uterus to the bony pelvis, we may briefly summarize as follows: The broad ligaments on either side prevent lateral displacement and aid in uterine support. I believe that the broad ligaments are only secondarily supportive in their action in the erect position. The round ligaments act as guy ropes to the fundus when the bladder is full, when the patient is in the recumbent position and also in the early months of pregnancy. They cannot be considered from their normal course or position as at all supportive in the upright position.

When the utero-sacral ligaments are taken into consideration, their function, when the body is in the upright position, is particularly supportive; in other words, as outlined above, they extend from the uterine body at its junction with the cervix, to the under surface of the only bony structure that is above the uterus when the patient stands. If you will think for a moment of the relation of the symphysis you will remember that it is below the uterus in this position. The attachment of these utero-sacral ligaments is particularly a point of vantage, namely: the second and third sacral vertebræ and the surface which is immediately adjacent thereto. The realization of this anatomical condition was first brought to my mind some ten years ago by a patient whom I saw who had been operated upon for retroversion and prolapse by the late Dr. P. F. Mundé, whose surgical ability was second to none, and whose large experience in this class of cases would certainly have qualified him in the choice of operation. He had performed a ventral fixation. When I saw the patient the fundus was firmly fixed to the anterior abdominal wall about an inch and a half above the symphysis. When the patient stood, the cervix traveled downwards in the arc of a circle, and allowed the rectum and bladder together with it to protrude en masse through the ostium vaginae, showing that while the fixation of the fundus held it firmly to the anterior abdominal wall, the stretching of the utero-sacral ligaments allowed the prolapse of the lower segment of the uterus, together with the cystocele and rectocele; the deformity thereby practically reproducing itself except that the fundus remained adherent in an abnormal position; and the anterior surface of the uterine body, through the intra-abdominal pressure, compressed the bladder against the superior surface of the symphysis. I have verified this observation many times since.

For the above stated reasons, it is my opinion that any operation looking to the relief of retroversion, retroflexion or either of these combined with prolapse, will fall short of giving the desired relief unless the elasticity and strength of the utero-sacral ligaments are taken into consideration; and I believe also that the reason that almost every anterior operation, that is, every operation on the fundus by fixation or suspension or some form of round ligament operation or broad ligament operation, has had its strong supporters, is the fact that in a large percentage of these cases, the utero-sacral ligaments are not stretched beyond their elastic limit and, therefore, any operation which holds the fundus forward will relieve the condition. Where, however, these ligaments are stretched beyond their elastic limit, any operation which only holds the fundus forward, will fail.

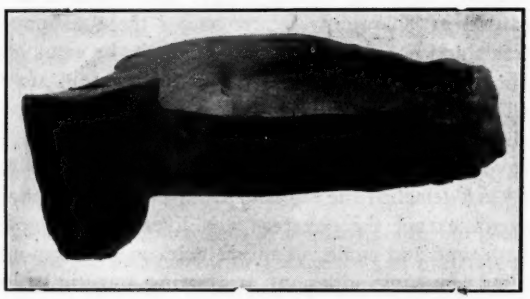

Figure 2.—Showing Relaxed Utero-sacral Ligament.

The next logical question that comes to my mind is, are these ligaments anatomically strong enough to fulfill their function, or is the term ligament not a true one, and are they merely bands of fascia covered by folds of the peritoneum? There can be no doubt that they are true ligaments, except where they have been stretched for years by prolapse, but in this condition all the ligaments surrounding the uterus become degenerated in the same way.

The utero-sacral ligaments are composed of fibro-elastic bands with some muscular structure, which are covered in turn by two thicknesses of the peritoneum. They may be easily seen when the abdomen is open, extending from their origin to their insertion; in the recumbent position, as usually seen, they are, of course, relaxed and extend laterally in a semi-circular manner, resembling the web between the thumb and forefinger when these digits are separated.

In making a vaginal examination, if the forefinger is used to lift the cervix well forward, the middle finger passed laterally will distinctly feel these strong fibro-elastic bands on either side of the rectum.

In following out any method of treatment for the relief of retroversion with prolapse, all indicated surgical procedures, such as curettage, repair of the cervix, perineorrhaphy, anterior colporrhaphy, and removal of hemorrhoids, must be performed as adjuncts to the operation prior to any intraabdominal work, and it is my experience that this work does not add greatly to the shock, and may be performed at the same time in most cases. The abdominal incision may be the usual median or the semilunar suprapubic. When the abdomen is opened, it is first wise to investigate the condition of the tubes and ovaries, and to do whatever work is necessary to these organs, at the same time breaking up all adhesions which bind the omentum, gut or adnexa to the uterine body. At this point of the operation, in order to facilitate the further procedure, the patient is raised to an extreme Trendelenburg position and the gut is carefully taken out of the pelvis and held above the brim of the true pelvis by pads soaked in normal saline solution. Too great importance cannot be laid upon this step of the operation as coils of gut dropping over the field of operation impede the work very materially.

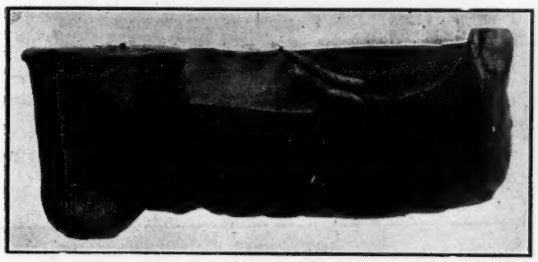

Figure 3.—The Same as Model No. 2 With Ligament Pulled Forward by Sponge Holder.

The contents of the pelvis are then brought fully into view. The fundus is grasped by a double tooth volsellum and held well under the symphysis so as to rotate the uterus on its midtransverse axis, thereby lifting the lower segment. The utero-sacral ligaments will then be seen at their insertion into the uterus at the corporo-cervical junction, and may be easily traced as bands extending in a semilunar manner on the sides of the pelvis. One ligament should be grasped in its mid-portion by a long abdominal sponge-holder and drawn well into view, its length and condition inspected, and the amount of shortening necessary determined. A stitch is then introduced through the uterine wall at the point of juncture of the ligament, this stitch giving a point of traction. Care should be taken to make this stich embody enough tissue to allow it to be drawn firmly without fear of tearing. By drawing upon this stitch and upon the sponge-holder already in place, the ligament will be brought well into view. It should then be grasped between the finger and thumb, and if the ureter is felt between the folds, it should be pushed aside laterally to avoid being included in the stitch. This accident is not at all liable to occur except in cases where adhesions have distorted the anatomical relations, or where there is very marked relaxation of the ligaments. Having identified the ligament and located the ureter, the next step is the determination of the point at which the ligament should be sewn to the uterine body. To do this, the sponge-holder should be drawn downwards, inward and forward, thereby putting on tension the outer or upper section of the ligament; then, by drawing upon the stitch already in place, a point may easily be determined at which the tension of the ligament will meet the requirement. This point is held by the sponge-holder and the stitch already in place is passed through the ligaments, to include all three layers,—the ligament near its insertion and both layers of the folded end. This brings the fold of the ligament on the inner side of its uterine inser-

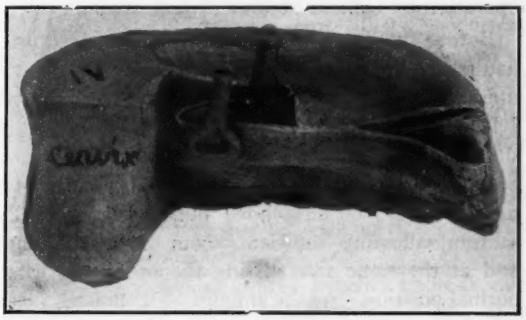

Figure 4.—Ligament Bent on Itself and Held in Position by Sponge Holder and French Clamp.

tion. The middle of that portion of the ligament is grasped between its origin and the stitch above described by a long thin-jawed French clamp. This is placed on the stretch by moving the point of the clamp backward, upward, and slightly outward. The three folds of the ligament will then be clearly seen. The reduplicated fold should be outward to the shortened ligament. A stitch is then placed running through the three layers, beginning at the outer, through the middle and then the inner fold,

at the point farthest from the uterine body. The same procedure is gone through with by a center stitch, midway between one at the junction of the uterine end, and the stitch nearest the sacrum. In placing these stitches too great importance cannot be laid upon the necessity of including all three of the folds of the ligament. A sharp knife is then taken, and the peritoneum covering the three folds is sacrificed. The next step is the taking of a fine catgut suture on a small needle and overhanding these three layers from end to end of the reduplication. This procedure is followed on the opposite side and the operation is completed.

For convenience of description the ligaments may be divided into three parts: First, the sacral or fan-like part—is fibrous and does not stretch, and forms the sacral attachment.

Second, the middle third—is the weakest portion and does stretch.

Third, the uterine third, where most of the fibro-elastic and muscular tissue is found, is strong and well developed.

In this operation the stretched middle third is eliminated, and the uterine portion is attached to the sacral portion. The weak middle third is used to strengthen the uterine portion and make its union to the sacral third more complete.

If the fundus is heavy and the round ligaments relaxed, one of the operations to shorten this ligament may be done at the same time, either the operation of Gilliam or that of Gill Wylie.

Before the development of my present technic, I had some trouble with retrodisplacement of the uterus. I have had no difficulty of that sort since I have followed my present method of shortening the ligaments. The amount of shortening must be governed by the judgment of the operator; the uterus should be suspended but not fixed to the sacrum, allowing sufficient room for the rectum, and at the same time lifting the uterus up to its normal position. As the amount of stretching varies greatly in individual cases, no fixed rule can be laid down as to the length of the fold in the ligament. There is undoubtedly, difficulty in the performance of this operation in stout people, or where there has been much mutilation due to the presence of growths or peritonitis. I do not feel that there can be any question as to the logic of this method, but I admit that it was an operation which I attempted to perform many times without ability to complete it, abandoning it for some one of the other procedures for the relief of the condition.

I have found that a No. 2 chromic acid catgut is sufficient to hold the ligaments in place; its slow absorption rendering union very perfect. For the running stitch I have usually used plain No. 1 catgut. The needle should be round, full-curved or fish-hook. Spear-point or Hagedorn needles are to be avoided. The needle-holder that has given me the best service is an extension-point long instrument. (Fig. 7.) The advantage of this is the point grasp which enables one to grasp the needle as it is passed through the layers of the ligaments.

This operation is contraindicated in very stout people, on account of the difficulty of its performance, and where there is retroflexion of the body of the uterus with little or no prolapse. It is of particular value in retroversion with prolapse and cystocele. I shall not burden you with a repetition of cases except to briefly report the following eight:

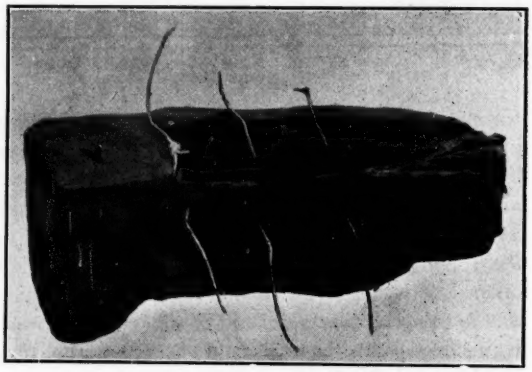

Figure 5.—Stitches in Place. Note Special Placing of the First Stitch.

E. W., single; age 20. Five years ago I operated for retroversion and mycrocystic ovary, and performed a ventral suspension with temporary relief. In about a year the deformity reproduced itself with return of all the symptoms. One year and a half ago I performed the sacral suspension with perfect anatomical result and relief of all symptoms. Menstruation has been regular and painless since. Relief of the neurasthenia has been very marked.

A. J., married; age 27; one child. This patient was referred to me by my friend, Dr. Douglas H. Stewart, who had performed trachelorrhaphy and posterior colporrhaphy. In this case the most marked symptom was a mechanical constipation of the most exaggerated type. At the operation, one year ago, the ligaments found were the longest I have ever seen, well marked but absolutely useless as supportive ligaments. On account of a very great laxity in the round ligaments a Gilliam operation was performed in addition to the sacral suspension. The patient has remained in perfect health since; she has normal evacuations without laxative.

E. W. N., single; age 30. The most marked symptom in this case was neurasthenia, with at-

tacks of true melancholia at the time of her menstrual periods, which had lasted for about ten years. Operation: sacral suspension one year ago. The patient has been anatomically normal, with absolute relief from neurasthenia and headache; menstruation normal.

T. K., married; age 28. Three children. Curettage, double trachelorrhaphy, perineorrhaphy, appendectomy, sacral suspension. This operation was

Figure 6.—Stitches Tied and Running Stitch in Place.

performed three months ago and is too recent to judge of the permanency of the cure, but it is reported simply to show that the addition of sacral suspension to the repair and other intraabdominal work is not too much for a patient even in poor general condition. The present anatomical condition is normal.

A. McC., widow; age 35; one child. The most marked symptom neurasthenia, verging on melancholia, severest about the time of her periods. Condition: retroversion with prolapse, laceration of the cervix and perineum. Operation, June, 1908: repair, with sacral suspension, together with Gill Wylie operation. The anatomical result was per-

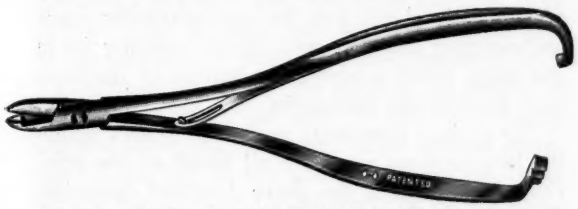

Figure 7.—The Extension-joint Needle Holder Used by the Author.

fect. The mental condition remained the same for some months after, but is at present greatly improved.

B. C., single; age 19. Most marked symptoms, dysmenorrhea, continuous backache and neurasthenia. Operation in July, 1908, curettage with sacral suspension. The result has been relief of all symptoms and examination shows normal anatomical retroversion.

A. E., single; age 27. Prolapse with retroversion. Symptoms, dysmenorrhea and backache. Operation, April, 1908; sacral suspension. The anatomical result was satisfactory and there was accompanying relief of symptoms.

A. P. A., married; age 31. One child three years ago. Operation, April 27, 1908. Uneventful recovery and perfect result. No pain in the back, no dragging of any kind, uterus in normal position. This patient was referred to me by my friend Dr. F. O. Virgin.

I have no case of pregnancy to report after operating.

The points of advantage in the operation are as follows: The supporting of the uterus in its normal position from the bony structure above; the body and especially the fundus are freely movable for all the functions of the body; it does not distort but reproduces the curve of Carus. There are no artificial bands through which intraabdominal hernia may occur. In the event of pregnancy there is no possibility of dystocia. It relieves the patient anatomically and symptomatically.

It is particularly indicated in retroversion of the fundus with antrosession of the lower segment of the uterus, or the condition of beginning prolapse.

CANCER OF THE BREAST*

WILLY MEYER, M.D.,

Professor of Surgery at the New York Post-Graduate Medical School and Hospital; Attending Surgeon to the German Hospital; Consulting Surgeon to the New York Skin and Cancer Hospital and New York Infirmary,

NEW YORK CITY.

The insidious and dangerous character of the disease under consideration and the unavoidable disfigurement following operation,—the only means that offers any chance of a cure,—justly render cancer of the breast, the dread of the female sex.

While we know that the disease may be cured, if treated early and radically, we also have learned that we cannot give a guarantee of such fortunate issue in a single instance. Since *early operation* constitutes our only weapon in dealing with this disease, the importance of such advice cannot be overrated.

Early operation, of course, depends upon an early diagnosis. Can we diagnosticate the disease at an early stage?

The diagnosis of mammary scirrhus is comparatively easy. The ease with which, ordinarily, the nipple can be pulled forward, and the hard, irregular nodule palpable, are signs plainly noticeable to a careful examiner.

It is different with adeno-carcinoma. This has no apparent effect upon the nipple; its growth is diffuse, simulating that of adeno-fibroma within which it not infrequently originates. Hence it cer-

* Being one of four papers in a symposium on this subject read before the New York Academy of Medicine, January 21, 1909.

tainly is not an easy task to diagnose adeno-carcinoma in its incipiency. Before there is sufficient evidence to betray its presence, the glands and subcutaneous tissue have frequently become involved, and if operation is not done until the disease has reached this stage, it is often too late, especially in younger patients.

To confound it with the so-called diffuse interstitial fibroma (diffuse chronic mastitis), is hardly possible. The multiplicity of the tumors in the latter, the small size of the axillary glands, if present at all, the painful development, and the fact that it often occurs bilaterally, are all signs diametrically opposite to those seen in adeno-carcinoma.

The diffuse fibroma belongs to the borderland cases; a suspicious adeno-fibroma, however, needs prompt radical operation. The fact, that now and then a breast may be sacrificed in which the microscope later fails to detect carcinoma, should be no deterrent. Better far, to err in this, than the opposite direction.

One word here regarding chronic *suppurative* mastitis. I have had a number of cases under my care, showing a diffuse, hard swelling which had developed after confinement and nursing and had persisted, sometimes for three or four years afterward. Now and then there was pain, usually little tenderness. These patients were sent to me for operation with the diagnosis of carcinoma. However, the long duration of the trouble, its diffuseness, the trace of the finger tip that persisted after pressure, and the fact, that the aspirator drew pus, a fluid that carcinoma never harbors, made me hesitate to accept the diagnosis. Simple incision effected a cure in these cases.

To remove such a breast on the possibility that the long existing inflammatory focus might produce a malignant growth, would certainly be going too far in our desire to be radical. In making our diagnosis, therefore, in tumors that admit of doubt as to their malignancy, we should never forget the use of the aspirator.

Before proceeding to present my results, I should like to briefly describe the method I employ.

Every one of my cases was operated upon by the procedure which was first published by me in 1894 (*New York Medical Record*, December 15). Its principal characteristics are, that the affected breast together with the two pectoral muscles in their entirety, plus axillary as well as subclavian glands and surrounding fat, are lifted out in one mass. All incisions are made within healthy tissue, as far as this is feasible. The work is done from the axilla toward the breast. Bloodvessels, arteries, as well as veins, are promptly divided at their exit from or entrance into the axillary vessels. The lymphatics are also first cut here, before the seat of the disease is approached. As the tendon of the pectoralis major muscle is primarily divided at the humerus, it is necessary to remove the whole muscle, *i. e.*, its clavicular portion included. The operation is typical, anatomical, simple and accomplished with a minimum loss of blood.[1] Its characteristic features have been absolutely maintained up to the present time.

In 1899 I made a slight change regarding the course of the axillary part of the skin incision. Prior to that time I had it run through the axilla. I then changed it so as to have it pass about two fingers' widths above the lower border of the great pectoralis muscle. This permits of a more effective shifting of the lower flap at the completion of the operation, making it possible to cover a greater part of the resulting defect. I have also discontinued the practice of dividing the upper flap by an incision toward the middle of the clavicle. One can well get along without it. Thereupon I form one large upper and one large lower flap, circumcise the base of the breast, without any regard to saving skin, and graft the resulting defect at the end of the operation.

The technic of the operation just described, I believe, could not be improved upon, unless the future should show that it is advisable to resect the clavicle in an osteoplastic way or permanently, in order to follow up in an unbroken course the entire chain of lymphatic glands into the supraclavicular space and extirpate the same with the surrounding fat in one mass, freely exposing the borders of the muscles, forming the landmarks.

The various operations devised by others within the last fourteen years are all based on the principles laid down in the above described operation. The only exception is the operation of Halsted, who, as every surgeon knows, saves the clavicular portion of the pectoralis major muscle and reunites the split halves of the minor. He works from the sternum toward the axilla. He published his procedure simultaneously with mine, in the fall of 1894.

The question as to whether we should remove the supraclavicular glands in every instance still remains open for discussion. Halsted has been most radical in this respect. He advises the extirpation of these glands as a routine measure.

The majority of surgeons who have studied this deadly complication of mammary carcinoma, have found the indication for this additional operation

[1] See *Journal of the American Medical Association*, July 29, 1905.

whenever the tumor had invaded the two upper quadrants of the breast, especially if it had become adherent to the skin, and subcutaneous tissues over this region, and this on the basis of the anatomical facts so well pointed out by Poirier, Cunéo and Delamere, in their work on "The Lymphatics," showing that the lymphatics of this portion of the breast feed just these glands. Personally, I have until now acted strictly upon this indication, all the more as these glands had not been removed in thirteen of my patients that remained well from five to twelve and one-half years.

However, a recent experience has set me to thinking whether it might not be wiser, after all, to add this operation in every instance (in weak patients perhaps in a second sitting soon after the healing of the wound of the first operation).

I will here briefly relate the case: Female, now 64 years of age. In July, 1900, I performed the radical operation for an ulcerating scirrhus in the outer layer quadrant. For eight years the patient remained in perfect condition. I considered her one of my star cases, inasmuch as she seemed to be in such perfect health the entire time and enjoyed absolutely unencumbered use of her arms. Eight years later, in May, 1908, she came to my office with a small tumor over the cartilage of the second rib. She had observed it for the last two and one-half months, but was afraid to come to me. Examination showed a local recurrence, slightly movable, as it seemed to me, at the site mentioned. When I operated a few days later, the tumor appeared to be sessile on this cartilage, involving the adjacent part of the sternum. It seemed diffusely connected with the surrounding tissues. As much of the growth as possible was lifted out with the help of a broad, grooved chisel and the wound closed without drainage. I did not do any additional operation above the clavicle, because I considered the patient absolutely doomed, expecting a prompt continuation of the disease in view of the cancerous elements that had to be left behind. The wound healed by primary union. In the absence of better means, I had her use a large, oval Bier's suction cup daily for forty-five minutes over the scar, six times, five minutes, with the usual three minutes' intermission, and, in addition, referred her for treatment to an *x*-ray specialist who gave her three exposures a week. To my surprise, the tumor has not recurred up to the present time, seven months since, but the supraclavicular glands were found involved three weeks ago. I did a very extensive removal, but found the entire supraclavicular space badly involved. In view of this state of affairs I could not but think that, had the supraclavicular space been cleaned out thoroughly in 1900, this patient might perhaps have been saved. As matters stand, I consider she can live but a very short time.

I here give my observation of the result of hyperemic treatment by means of the suction cup, for what it is worth. Reliable data as to its favorable action upon inoperable sarcoma are at hand.[2] After my personal experience, I shall certainly use it as an adjuvant in the after-treatment of operating fields that could not be cleaned of the disease even macroscopically.

Another phase of the disease not infrequently met with, I think, deserves to be briefly mentioned in this connection. I refer to carcinoma of such accessory mammary glands as are found in the axilla or in the upper outer quadrant of the breast, either attached or unattached to the breast. One cannot be too careful with these tumors. I have had two sad experiences which have shown me beyond a doubt, that it is unwise, in these cases, to do anything short of a radical extirpation of the breast, including, of course, the removal of the accessory gland.

In the first I had removed a beginning carcinoma of a typical accessory breast in the axillary cavity in a woman of 47. The wound healed by primary union. Not quite two and a half years later the patient came to me with a distinct cancer in the breast. A radical operation was performed eighteen months later, a recurrent tumor had to be removed from the axilla, necessitating resection of the axillary artery. One year later the patient died of internal metastases.

The second case came under my care last summer. This was a young mother of 28 years, who had noticed a small tumor near the anterior aspect of the acromion, not connected with the breast. She was sent to a surgeon who removed the tumor under cocain. One pathologist pronounced the tumor carcinoma, a diagnosis which was questioned by others. Unfortunately there was some mix-up with the specimen and the case was allowed to go on without further operation. Five months later an infiltrating tumor had invaded the upper outer quadrant. Then the breast and glands were removed. To-day the patient has an inoperable glandular infiltration in the supraclavicular region with multiple metastases.

I cannot help but think that had these cases been subjected to radical removal of the breast, including the original tumors, the outcome might have been different.

[2] Muenchener Med. Wochenschr. No. 43, p. 21-24, 1907.

Now, as to my statistics. They represent the end results and could be added to those reported by thirteen other surgeons before the meeting of the American Surgical Association, held at Washington, in May, 1907.[3] I should have been glad to trace the surviving cases up to the present, but the time within which I have had to prepare this paper was insufficient for such an undertaking.

My series, as far as traced, comprises eighty patients operated upon by means of the radical operation, described above. Sixteen of these were operated upon from ten to twelve and one-half years ago, *i. e.*, between September, 1894, and April, 1897. Of these, three, or 18.7 per cent., were alive and well from eleven to twelve and one-half years after operation. I happen to know that these three patients are enjoying perfect health to-day.

Of twenty-seven patients operated upon from five to ten years ago, *i. e.*, between April, 1897 and April, 1902, six, or 22.2 per cent., were alive and well in May, 1907, from five and three-quarters to nine and one-half years after operation.

Of the forty-three patients operated upon between September, 1894, and April, 1902, seventeen, or 39.5 per cent., remained free from recurrence from three to twelve and one-half years after operation; and thirteen, that is, 30 per cent., from five to twelve and one-half years after operation.

Twenty patients were operated upon from three to five years ago, *i. e.*, between April, 1902, and April, 1904. Of these, ten, or 50 per cent., were alive and well twenty months ago.

I will omit the end-results of the seventeen patients who were operated upon within the three years preceding April, 1907, the date of my statistic. They are of no special value, being too recent to permit of any conclusions.

Of the remaining sixty-three cases operated upon more than three years prior to May, 1907, twenty-eight, or 44.4 per cent. lived from three to twelve and one-half years after operation.

Forty of my eighty cases, or 50 per cent., died of the disease within three years after operation. Twenty-four of these within one and one-half years after operation.

I wish to add that my cases were operated upon as they came along. I have never refused the operation, nor selected my cases in order to improve my statistics.

In conclusion I should like to say a few words regarding the so-called borderland tumors, *i. e.*, fibro-adenoma, diffuse chronic mastitis, cysts, etc., which now and then are the precursors of carcinoma. The more I have seen of this class of cases, the more I feel convinced that the only safe plan is to operate upon every case over twenty-five to thirty years of age, and not allow them to go on until unmistakable signs of malignancy have become apparent, when it may be too late to help the patient.

I fully agree with Dr. Gibson's views as expressed in his instructive paper, read about a week ago, before the New York Surgical Society. In these cases the tumor should be removed by all means, and this is best done by lifting up the breast with the help of an incision at the junction of the breast and chest, at the base of the two lower quadrants, as originally advised by the late T. Gaillard Thomas, of New York, in 1882, on basis of twelve cases successfully operated upon in this manner (*New York Medical Journal*, 1882, p. 337) and later worked out further by F. Collins Warren, of Boston (*Journal of the American Medical Association*, 1905, July 15, p. 149). Then, if the pathologist (who should be present on these occasions) pronounces the tumor undoubtedly malignant, the necessary radical work may be at once added. In cases in which there exists doubt as to the true nature of the growth, and more time is needed for more careful examination, the wound will have to be closed and the radical work done at a second sitting, if found necessary.

It must be our aim to train physicians as well as the laity to recognize the serious character these troubles *may* assume, especially if occurring in the fourth and fifth decades of life. If operation be promptly done in these cases, we may hope to succeed in removing the malignant tissue—if such be present—before glandular infection has occurred, before the first metastatic deposits have been made.

By widening the indication for operation so as to include this class of cases, we may look for gradual improvement as regards the late results of the radical operation for carcinoma of the breast.

But perhaps the goal toward which so much effort has been directed within recent years, both here and abroad—the discovery of the cause of cancer—is not as far off as we think.

Let us hope that the man has been born, who—like Schaudinn did in regard to syphilis—will find the protozoon and its various species that perhaps is the cause of cancer.

Summing up, I would say, that we may hope to improve our end-results

First, by early radical operation, based on early diagnosis;

[3] Surgery, Gynecology and Obsterics, Vol. V, No. 1, July, 1907.

Second, by educating the public to understand that the painlessly developing tumor is the most dangerous one;

Third, by operating also upon circumscribed apparently benign tumors, which may become transformed into malignant ones;

Fourth, by finding the cause of carcinoma.

ON THE SURGERY OF FOREIGN BODIES, WITH ESPECIAL REFERENCE TO THOSE OCCURRING IN THE SKELETAL TISSUES. INCLUDING THE DESCRIPTION OF A LOCALIZING METHOD.

WALTER M. BRICKNER, M.D.,

Assistant Adjunct Surgeon (and Chief in Surgical Out-Patient Department), Mount Sinai Hospital; Surgeon to the New York Sanitarium for Hebrew Children,

NEW YORK.

In the consideration of this subject I shall not deal with the removal of foreign objects from the organs or cavities of the bodies. They constitute, for each location, a special surgery, elaborately considered in the literature. I shall discuss, rather, the surgery of those, usually small, foreign bodies which so frequently become imbedded in the muscles and fasciae, especially of the hand and foot. This subject, largely within the domain of so-called minor surgery, has been, perhaps for that reason, largely neglected by our text-books. Yet probably no single problem with which the surgeon is called upon to deal is more tantalizing, technically, than the removal of small foreign bodies lost within the muscles; and certainly this often requires, for its accomplishment, no *minor* skill. I, therefore, do not feel the need of an apology for presenting here some observations on the subject acquired in an experience of not a few years in the clinic and in the *x*-ray laboratory.

INDICATIONS FOR REMOVAL.

The immediate treatment of bullet wounds has been established by military surgeons and does not concern us here. Nor, again, do the indications for, and contraindications to, the removal of foreign bodies from special organs, *e. g.*, the brain. Speaking broadly, foreign bodies in accessible parts, and especially in the hand and foot, should be removed; foreign bodies deeply imbedded in the bulkier parts, or otherwise not readily accessible, may be left unmolested if they are producing no symptoms, and if they threaten no trouble, either by their character or by their location. When it causes suppuration, a foreign body is usually easily found, but if there be difficulty in locating it, it is better to be content with drainage for a few days rather than expose uninfected areas by a prolonged search.

SYMPTOMS.

In many cases, even when the injury is very recent, there are no symptoms. In other cases the symptoms that may be produced by foreign bodies in the skeletal tissues are: *spontaneous pain, tenderness, inflammation, impairment of function.* In the presence of one or more of these symptoms and a sugestive history, one should not allow himself to deny the presence of a foreign body merely on the report of a hasty fluoroscopic examination. To be sure, a foreign body that has entered but has not remained in the tissues may produce these symptoms for a greater or less time and to a greater or less degree. And, of course, neurasthenics exaggerate their pains an are susceptible to suggestion; but the old observation cannot be too often repeated that the physician who is quick to attribute symptoms to "neurasthenia" is in danger of being frequently put to shame by more painstaking colleagues.

Even in the absence of a suggestive history, one should bear in mind the possibility of a foreign body as the cause of localized pain, tenderness, inflammation or impaired function, when the cause cannot otherwise be determined. Let me illustrate by two instances:

A woman was referred to me because of an area of persistent pain, tenderness and swelling in her left deltoid region which had not responded to her physician's treatment. Finding no other explanation, the location of the lesion suggested to me the possibility of a hypodermatic injection as its cause. The patient did not recall having had any injection, but her husband then told me that some weeks previously, during an illness, one had been made, in great haste, at that part. The physician then in attendance did not report, what a skiagraph now showed, that his needle had broken off in the tistues.

A man came to the dispensary complaining of pain in the sole of one foot, and swelling in the metatarsal region. There was a linear scar along the dorsum, and the patient stated that he had recently been operated upon in one of the hospitals of this city for some disease of the bone, he thought. Believing that a continuation of the osteal disease was probably causing the pain and swelling, I had a skiagraph made. The picture showed normal metatarsal shadows and between two of them the shadow of a slender metallic ob-

ject about four inches long. It looked very much like the skiagraph of a surgeon's probe—whether there by accident or design, I do not know. The patient did not return for treatment.

Needle thrusts are often only slightly painful, and thus it occasionally happens that there is buried in the tissues a fragment of needle, the entrance of which the patient did not appreciate or has quite forgotten.

Creeping infants may gather wood splinters or needles in their hands or knees, and abscesses in those localities should suggest such an etiology.

LOCALIZATION.

While all four of the symptoms mentioned above are suggestive of the presence of a foreign body, two of them—*inflammation* and *tenderness*—may be actually diagnostic of its location. Thus, at the bottom of a suppurating tract resulting from the lodgment of a foreign body, lies the body itself. Circumscribed tenderness is especially significant of the location of the object. One must, of course, make allowance for the tenderness due to infection, when this is present. Properly elicited, however, a point of persistent maximum tenderness is fairly diagnostic of the location of the body beneath that point. By pressure, with the finger tip or a slender instrument, on one spot after another in the suspected region, one may elicit only a single point of tenderness, or a point of maximal, and several adjacent points of lesser tenderness. The single or maximal point indicates usually the location of the most superficial part of the foreign body, especially if it be a needle or sharp splinter of glass, wood, etc.; the points of lesser tenderness map out, in a rough way, the general direction of the body. It has repeatedly happened, in the out-patient department, that assistants have localized a foreign body with the fluoroscope at an area more or less remote from that which the point of entry, the pain and the tenderness have made me believe that it occupied; and each time they have been convinced, by their efforts to remove the object, that the clinical signs were more accurate than their interpretation of the fluoroscopic picture.

The character of the injury, the nature of the entering body and *its point of entry, the duration of time* that it has been in the tissues, are all factors more or less helpful in estimating the location of the object. Unquestionably needles, and perhaps other very slender metallic bodies, that have been long in the tissues, sometimes migrate great distances. But when the injury is recent foreign bodies, including needles but, of course, excluding bullets and other objects traveling with great force and speed, will be found to lie not far from the point of entry. Indeed, if one had no means of localization, and made his incision through, and a patient dissection beneath, this point, he could remove a large percentage of foreign bodies. Needle fragments will travel further from their entry than bulky or irregular objects, such as glass and wood splinters are apt to be. The more violent the impact the more deeply will the object be thrust, as a rule; and the patient's account of the injury is therefore valuable. Sewing machine needles are often driven through the terminal phalanx, an accident that does not happen in hand sewing. A needle entering the palm while wiping a table will usually not penetrate as deeply as one encountered during vigorous polishing. Needles are more often thrust into the fleshy part of the palm (the thenar and hypothenar eminences, and the area joining them near the wrist) than in other portions; and more often into the ball and heel of the foot than into the midsole. A needle fragment in the fleshy palm, where the muscles are compact and in more or less constant activity, will, I think, be displaced more in a few hours than one in the sole of the foot, where the intrinsic muscles are deeper, less compactly disposed and less active, and where, also, the dense plantar fascia sometimes holds the needle. In the palm foreign bodies, by reason of the direction of the thrust, often point towards the dorsum and, in a general way, towards the center of the wrist, and such movements as they undergo by muscular contractions carry them further in those directions. Slender objects entering the sole are usually driven upwards and backwards. In the heel there are no muscle bellies to move them and I doubt that the impact of walking much disturbs the primary locus.

When an open wound accompanies the injury the foreign body (glass, bullet, etc.), may often be located by means of *probing*—a procedure not to be recommended for deep bullet wounds, however.

Finally, of course, foreign bodies occasionally lie, wholly or in part, palpably in or beneath the skin.

But in spite of all these considerations it must be confessed that in most instances we would be wholly at a loss for accurate localization, without *the x-rays*.

In civil practice, in my experience, at least, foreign bodies are lost in the skeletal tissues in about the following order of frequency: 1. Sewing needles. 2. Glass fragments. 3. Wood splinters. 4. Fragments of steel, brass, etc. 5. Blank cartridge wads (most often on July 4th). 6. Powder grains. 7. Bullets and shot. 8. Miscellaneous

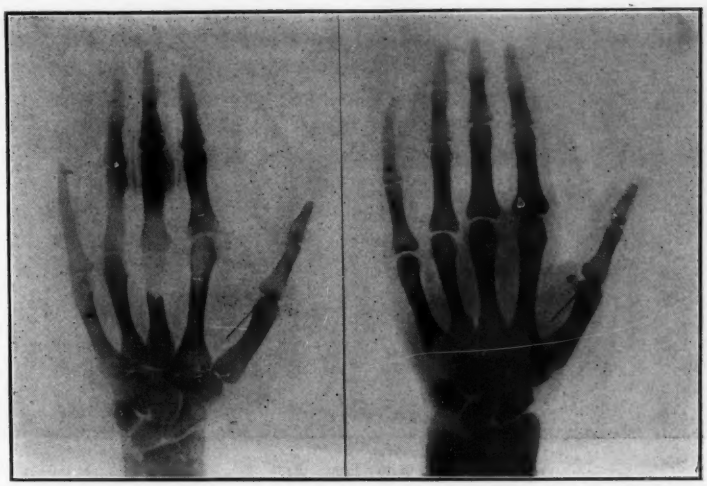

Figure A.—Stereoscopic radiographs of a needle in the hand. Reduced for the hand stereoscope.

bodies, *e. g.*, broken hypodermatic needles, pieces of bone, shell, etc., pen nibs, pencils, and large portions of metal and wood from impaling accidents. All the objects on this list are demonstrable by the *x*-ray except cartridge wads and powder grains,—which require no localization, and wood fragments,—which are usually deposited not far from their site of entry.

When a patient presents himself with a foreign body in his skeletal tissues, it too often happens that a cursory fluoroscopic examination or a single skiagraph is made, and on the basis of this slender localizing evidence, the extraction of the object is undertaken. In such cases the surgeon is doomed to disappointment or his patient, at any rate, is subjected to an unnecessarily extensive operation.

Concerning fluoroscopic localization two sets of facts must be emphasized. First, repeated examinations are disastrous to the surgeon (unless, as is rarely the case, he has elaborate protective apparatus); and a prolonged examination is often disastrous to the patient. Second, fluoroscopy does not lie, but it does deceive the inexpert.

Fluoroscopic localization must be undertaken systematically deliberately, but expeditiously. The shadow of the body having been seen, the part should be moved before the tube until it reaches a point where slight movements produce minimal excursion of the shadow and minimal changes in its shape. At that time the body is on a line with the tions of the shadow to the bone and skin outlines be noted with a probe and marked on the skin, these marks will represent, *approximately*, the levels of the extremities of the object; and the relations of the shadow to the bone and skin outlines should now be carefully noted. Keeping the shadow on the line between the eyes and target, if the part be now rotated through a right angle, the shadow then seen will afford an *approximate* expression of the depth of the body. A combination of the images thus seen (or similarly preserved on *x*-ray plates) will *approximately* determine the level, depth, direction and length of the object—but *only* approximately.

When the fluorescent screen is held at right angles to the beam of *x*-light the shadow is foreshortened (unless the object is parallel to the screen, in which case its shadow is slightly larger than itself), and so the part must be rotated to various angles in order to estimate the length of the object. Next rotating the part in the plane of the fluoroscope, *i. e.*, around an axis represented by the beam of light, one notes that one end of the shadow of the foreign body has a wider excursion than the other. The end moving most is deepest. If one end, or all of the shadow, moves but little, it is lying superficially (*i. e.*, near the skin facing the examiner), and if, on changing the angle of the parts to the *x*-rays, one end moves scarcely at all, it must lie just beneath the skin. If the shadow of the bone excurses more, on moving the part, than the shadow of the object, the bone lies deeper than the object, and vice-versa. The relative excursions of the two shadows will afford an estimate of the depth relations of the bone and the object. When part of the shadow of the object is inseparable, on free rotation, from the bone shadow, that part of the object, lies in, or in contact with the bone. When

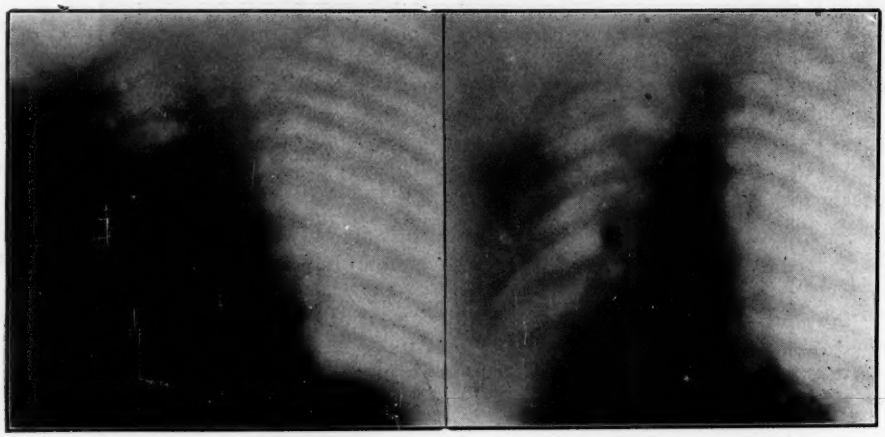

Figure B.—Stereoscopic radiographs of a bullet in the lung. Note the relations of the shadows of the bullet, and of the metallic "markers" placed, respectively, on the sternum and on the spine. (This is an unsatisfactory reproduction of two 11 x 14 negatives which, in the large instrument, produced an excellent stereoscopic effect.)

the relations of the target and the plane of the screen are gauged, it is helpful, especially in fluoroscopy of bulky parts, to note the relations of the shadows of the foreign body and of probes placed at various levels on the skin, and with the part placed at different angles. There are other devices for more exact fluoroscopic localization, and, indeed, some elaborate methods for securing accurate data.* Into these I shall not enter. The localizing methods described below are not only more satisfactory but also less hazardous to the patient and the examiner. If the mistake were not often made, it would be scarcely necessary to remind the reader that the shadow of a foreign body may be simulated by a defect in the fluorescent screen.

Stereoscopic radiography† affords the most vivid localization (and permanent representation) of foreign bodies, since it reconstructs before the eye, the object, the bones, and some of the soft parts, in all the dimensions of space. For foreign bodies in the extremities, and especially in the joints, it affords, in my experience, the most satisfactory localization for the surgeon. (See Figure A,—stereoscopic radiographs of a needle in the hand, reduced for the hand stereoscope.) And, indeed, its value for all parts of the body is very great.

In addition to the stereoscope itself, two details of equipment are essential to stereo-radiography: (1) A device for moving the vacuum tube, between the two exposures, an exact distance in a horizontal line, usually transverse to the part examined. (The distance between the visual axes, about two and a half inches, is the distance through which the tube is displaced.) (2) A means of placing two plates, successively, identically under the part examined. without in the least disturbing the position of that part.

The writer has described* a wooden *x*-ray tube-stand (Fig. 1), of which the tube arm, bearing an inch scale can be moved by hand wheels, vertically on the graduated upright, and horizontally behind an indicator; and an *x*-ray table (Fig. 2) on one side of which slides this tube-stand, modified. The top of the table is divided into a fixed and an adjustable portion, each of fiber, marked off in small squares; and beneath each of these is a wooden plate-holding shelf, correspondingly marked, and so adjusted that the *x*-ray plate can be brought to lie immediately beneath the fiber top, at the proper place. Lacking these, or other apparatus designed for stereo-radiography one can, no doubt, extemporize some means for properly displacing the tube; and for the plates one may use a wooden slide, or box, open at one end, as shown in Figure 3. The box may be made to accurately accommodate plates of various sizes by inserting appropriate wooden obturators.

Stereo-radiography, valuable as it is, has certain limitations: An apparatus for examining the negatives is not always available; and to reduce these for the hand stereoscope is expensive, time-consuming and not always satisfactory. (The stereoscopic radiographs of a bullet in the chest in Figure B, are quite disappointing, although they were re-

* See Bouchard: *Traité de Radiologie Medicale.*

† Mackenzie Davidson devised, and Caldwell has modified, an apparatus for stereo-fluoroscopy. It is no tgenerally employed.

* "A New *X*-Ray Tube-Stand; A New *X*-Ray Table," AMERICAN JOURNAL OF SURGERY, April, 1905; *Archives of the Roentgen Ray*, February, 1906.

duced from negatives which afforded an excellent demonstration in a large stereoscope.) The stereoscopic effect is not always satisfactory even in the negatives; this is true most often of the larger parts of the body, since the contrasts are less marked, and the tube must be a considerable distance from the plate. Stereoscopic pictures often exaggerate depth relations. Finally, these relations must be judged by the eye, actual distances are wanting, and they are sometimes very important, as, for example, for the removal of a foreign body in the brain.

In addition to the methods of localization above discussed, we sometimes need, therefore, a system of *mathematical localization*. Some years ago, when

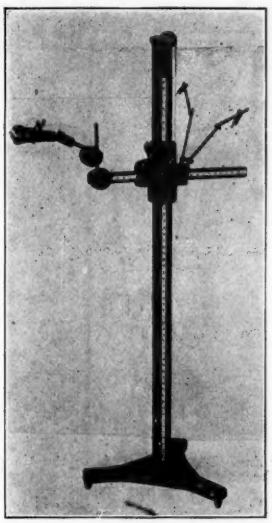

Figure 1.—Author's *X*-Ray Tube Stand.

in charge of the *x*-ray department of Mount Sinai Hospital, I devised a method of localization which I have hitherto hesitated to describe because its very simplicity has made me believe it not unlikely that it has also occurred to others. Like all other localizing methods it depends upon the principle of shadow projection or triangulation. But, unlike the methods of Mackenzie Davidson and others, it needs neither a special apparatus nor elaborate calculations.

The armamentarium for the exposures is the same as for stereo-radiographic exposures; and for the calculations one needs only the negatives, a large sheet of paper, a long ruler and a pencil, to which may be added a pair of calipers. The other essentials are a plumb line, a memorandum of certain distances used in the exposures, a fixed point marked on the skin, and a metallic "marker" placed over that point.

The patient's body having been carefully disposed on the table the fixed point on the skin is selected. This should preferably be some bony landmark near the general location of the foreign body. If the chest is exposed one selects some point on the midsternum or the spine; if the thigh, an arbitrary point; if the head, the most prominent portion of the exposed malar bone; if the foreign body is in the brain one may measure out on the scalp one of the landmarks known to cerebral topography. Whatever spot is selected is painted with a drop of some dye or, more durably, of silver nitrate solution. Over this spot is laid, or fastened with isinglass plaster, some small metallic object of distinctive shape, to serve as a "marker."

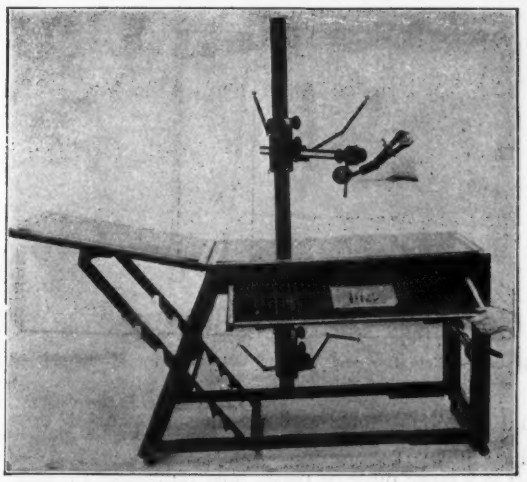

Figure 2.—Author's *X*-Ray Table (Opened), showing one of the two plate shelves.

At a convenient height the *x*-ray tube is now adjusted so that the target is directly over the marker. This is determined by means of a plumb line. The plumb line illustrated in Figure 4, was made for me by the Wappler Electric Controller Co. (who also manufactured the tube-stand and the table). On this instrument we read off, and note on a piece of paper, the exact distance between the marker* and the glass tube just below the target. (BC in Figure 5.) A plate is now placed in position (a metallic object fastened over one corner of the en-

* The marker, or an additional marker, may be placed on the skin next to the plate. But on the under part of the body, it is less accurately brought in a vertical line with the target, and, its shadow undergoing little displacement, the projection lines in the diagram may fall too close for accurate determination.

In this connection, however, may be mentioned a device for determining the levels of the vertebrae in a stout subject. An arbitrary spot on the spine is covered with a marker and, with the patient supine, a skiagraph is made on a plate large enough to include the first or the last rib. The vertebrae are counted on the plate and a note is made of that one nearest to the shadow of the marker, the skin beneath which had previously been painted with silver solution. This was done in the case of which the skiagraphs are shown in Figure B.

velope will serve, by its shadow, to distinguish it afterwards as plate No. I). The tube is displaced a measured distance to the left (Figure 5, AA′) and the first exposure is made. The first plate is replaced by a second one,* the tube is moved a measured distance to the right (AA″), and a second exposure is made.

The displacements of the tube may be quite arbitrary, but if they are made each one and one-quarter inches from the median position, the plates will also afford a stereoscopic view, and the two methods may be thus combined. After (or before) the exposures are made there is measured with the plumb line the distance from the tube to the table or plate box. (B D). Also with calipers, measurement is made of the vertical line (A B) between the target

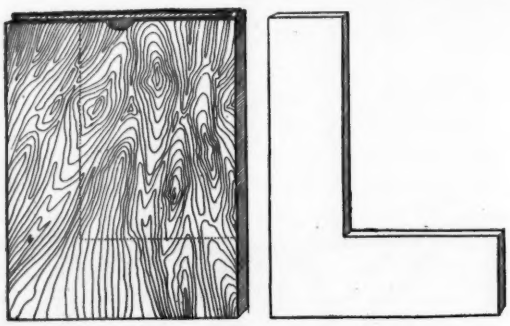

Figure 3.—Plate Box and Wooden Obturator, for stereoscopic or localizing radiography.

and the glass tube. (This measurement is only approximate.†

On a large piece of paper now reproduce the conditions of the exposures, as in figure 5. Draw the horizontal line *x x* to represent the top of the table or plate holder, and below it, at a distance equal to the thickness of the table top or holder, draw the line *y y* to represent the plate. Measure off the vertical line A D equal to the sum of the measurements B D and A B. Mark off on it the distance B C. C now represents the marker. Measure off the horizontal tube displacements A A′ and A A″. A′ is the target in the first exposure, and A″ the target in the second exposure. Draw through the marker C a line from A′ to the plate line *y y*. The point of intersection E′ represents the projection or shadow of the marker on the first plate, and similarly E″ is marked to represent the shadow of the marker on the second plate.

* Both exposures may be made on one plate, but this invites confusion, and does not allow the use of the negatives for stereoscopy.

† Caldwell has described (Pusey & Coldwell: *The Roentgen Ray in Therapeutics and Diagnosis*) a method of accurately measuring the distance between the target and the plate. It involves an additional, though not complicated, apparatus, and an extra set of skiagraph measurements and triangulations. This refinement, it seems to the writer, is rarely necessary.

Now on the first skiagraph measure off (preferably with calipers) the distance that a vertical line through the shadow of the foreign body lies to the left or the right of a vertical through the shadow of the marker. Lay off this distance (E′ I) on the line *y y* to the left or right, respectively, from E′. I represents the shadow of the foreign body on the first negative. Draw the line A′ I, the path of the light through the foreign body in the first exposure. On the second skiagraph measure similarly the horizontal distance between the shadows of foreign body and marker and lay this off E″ J in the proper direction from E″ on the plate line. Draw the line

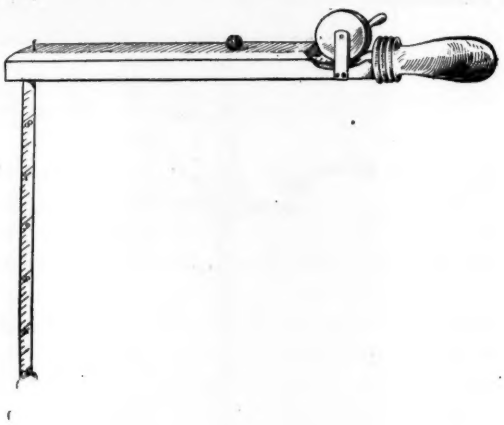

Figure 4.—Plumb-line. The distance from the tip of the weight to the tip of the nail is read on the tape where it emerges from the staff.

A″ J, the path of light through the foreign body in the second, exposure. The intersection of A′ I and A″ J at O′ represents the foreign body itself. The length of its coordinates O′ O and O D, as measured on the paper, are the distances that the foreign body lies from the planes A D and *x x* respectively, *i. e.*, in the case of a chest, from the midsagittal line of the body and from the skin over the spine, in the horizontal plane.

To determine the level of the foreign body in the vertical plane we may use the same or another diagram (figure 6). Draw the lines *x x* and *y y*, and the line A E (the perpendicular distance of the target from the plate in both exposures). E represents now the shadow of the marker. On either plate (the measurement is the same on both) determine the vertical distance that the shadow of the foreign body lies above, or below, that of the arker, and lay off this distance E Q above or below, respectively, the point E on the plate line *y y*. Draw A Q, the path of light through the foreign

body. Measure off D O, the horizontal depth of the foreign body as previously determined, and draw at right angles to it the line O M. The length of this line is the actual distance of the foreign body above, or below, the horizontal plane through the marker.

In the above description, and in the diagrams, the foreign body has been considered for simplicity, as a single point. In practice, however, one may plot out in the same way the extremities of the shadows

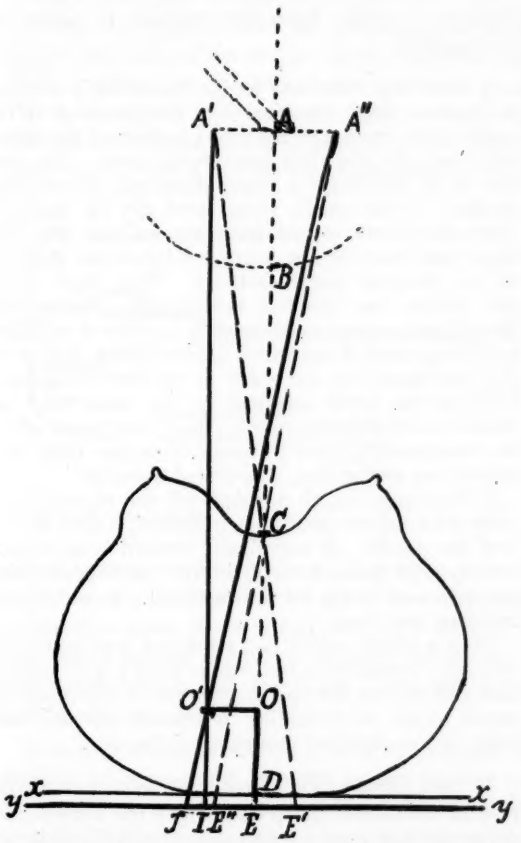

Figure 5.—Author's Localizing Method. Representing the localization of a foreign body in a horizontal plane of the chest.

xx, the top of the table; *yy*, the position of the plates; *C*, a spot over the sternum marked by nitrate of silver and covered by a metallic "marker"; *A*, target of tube when centered vertically over *C*; *AB*, distance between target and wall of tube; *BD*, distance between tube and table; *AA''*, horizontal displacement of tube for first exposure; *AA''*, horizontal displacement of tube for second exposure; *E'*, shadow of marker in first exposure; *E'I*, horizontal distance (to the left) of shadow of foreign body from shadow of marker on first plate; *I*, shadow of foreign body on first plate; *E''*, *E''J*, *J*, points and measurement, on second plate, corresponding, respectively, to *E'*, *E'I*, *I*; *A'I*, projection of foreign body in first exposure; *A''J*, projection of foreign body in second exposure; *O'*, the foreign body; *OO'*, its distance from (to the left of) median sagittal line; *OD*, its depth from the back.

of the object, and thus determine its shape, dimensions and direction.

This method is most exact for the chest and the head, the outlines of which are practically fixed, and the bony landmarks numerous. In the chest one may easily translate the measured relations of the foreign body with the painted spot on the skin, to relations with vertebrae and ribs.

In the case of which stero-radiographs are reproduced in Figure B, a bullet had entered at the left shoulder. A single skiagraph showed its shadow between those of the 6th and 7th ribs to the left of the spine. A search through the muscles at that area failed to reveal it. Two plates were then exposed by this localizing method, the tube being displaced 2½ inches in order to allow stereoscopic examination also. The stereoscope showed the

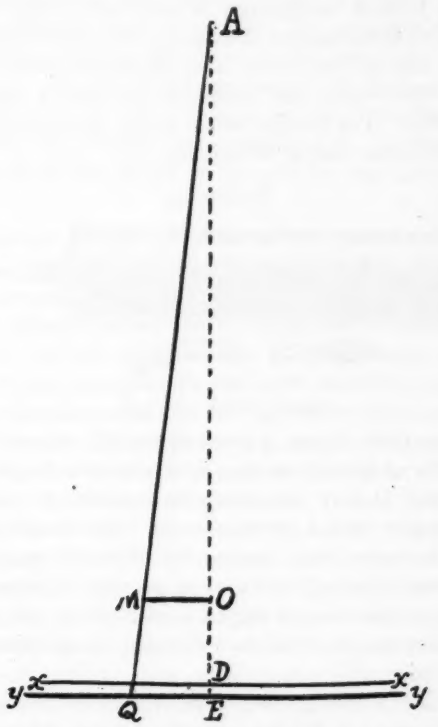

Figure 6.—Localizing Method. Representing the determination on a vertical plane of a foreign body in the chest.

A, represents horizontal line occupied by target in both exposures; *xx*, *yy*, *AE*, *DO*, as in figure 5; *E*, shadow of marker; *EQ*, vertical distance of shadow of foreign body from (above or below) shadow of marker on plates; *AQ*, projection of foreign body in both exposures; *OM*, actual distance of foreign body (above or below) horizontal plane through marked spot on skin.

bullet apparently deeply imbedded in the lower lobe of the left lung. The localization placed it more precisely on a level with the 7th intercostal space, 1⅝ inches to the left of the midline of the spine and at a depth of 2¾ inches from the skin of the back. A fracture of the second rib on the left side, posteriorly, was also noted. The next day there were signs of pneumonia at the left base. From this complication the patient died.

In the head the measurements from the spot over the malar bone or other landmark may be so inter-

preted, by a study of the skiagraphs and of an average skull or brain, that one may determine, with fair accuracy, in what recess of the head the foreign body lies or, again, by its depth and distance from a marked spot over the Rolandic or Sylvian fissure, in what area of the brain it is lodged.

For the soft parts of the body, e. g., the abdomen or thigh, the method, like other localizing methods, is less exact—both because the outlines are not permanent, and also because, during the search, landmarks are absent and distances are of comparatively little service. For the slender parts of the body (hand, foot) I have not tried the method, both because stereoscopy is very satisfactory and because the estimated distances of the plate from the skin, and of the target from the circumference of the tube, might here introduce too large a margin of error. For foreign bodies in the eye the method is, of course, not at all suitable.

REMOVAL.

Occasionally, to be sure, no special technic is needed. Objects just beneath the skin may be removed through a simple incision under analgesia by freezing or infiltration. If one end of a needle projects superficially, by squeezing the muscles in the proper direction, from beneath its deeper end, it can often be driven through the skin and extracted without incision. Again, a wood or metallic splinter under the nail rarely needs a local anesthetic for its removal. It may sometimes be removed by simple extraction with a strong forceps. It is usually better, however, both because the object is apt to be broken off short, and also to provide drainage, to remove a narrow V-shaped section of the nail over the object. A small *wet* dressing should then be applied.

When a foreign body can be seen or felt in an open wound, it may be extracted through the wound, enlarging it, if necessary, by retraction or incision. If the injury has been by glass or china, or if the wound contains metal filings, it should be thoroughly irrigated, and then submitted to the *x*-rays to determine whether or not all fragments have been removed.

These are the exceptional cases. The removal of foreign bodies from the skeletal tissues is usually a much more difficult matter, and its nice surgery involves certain essentials of technic. *Accurate localization* is the first of these, and it has, therefore been considered at some length. The other essentials are: *ischemia* (for the extremities); *anesthesia* of the parts; *good light; intelligent assistance; precise anatomical dissection* (which includes familiarity with the location and direction of the structures in the field of operation); *exploration with the ungloved finger tip;* and *patience.*

The patient should be fully recumbent. If the sole of the foot is to be operated upon, it is brought to the end of the table and raised to a convenient level; if the hand or arm, this is laid on a side extension or small table.

If the skin is grimy it should be freely washed with turpentine, benzine or ether. Thorough cleansing is important, but too vigorous scrubbing may displace a needle from the position in which it was located.

A child was admitted to Dr. Lilienthal's service at Mount Sinai Hospital for the removal of a needle that entered at the *right* border of the sternum opposite the fifth intercostal space. On the day of her admission a single skiagraph showed the shadow of the needle lying *vertically* on the *left* side, about two inches from the median line, its upper end touching the lower border of the shadow of the seventh costal cartilage. Two days later Dr. Jaches, the hospital radiographist, submitted the patient to stereo-radiography combined with the localizing method described above. Both indicated that the needle lay *vertically* in the abdominal parietes on the same side and at the same level as shown in the first negative. About two hours after the localization, during which time the child remained on a stretcher, I operated upon her.

A thorough search through all the tissues in a wide area about the region indicated, failed to reveal the needle. It was finally located lying *transversely* and quite *loosely,* in the peritoneum and preperitoneal tissue on the *right* side, its outer end touching the liver.

That a needle which had remained stationary for two days should have undergone such a wide excursion just before the operation must be attributed, it seems to me, to struggling in primary narcosis and (or) to too vigorous cleansing of the skin.

In such cases as the above, especially, it is advisable to administer morphine before the narcosis, to wash the skin gently, and, when it is convenient, to secure a final *x*-ray determination, just before the last cleansing.

In the extremities the field should be rendered bloodless by the employment of a constrictor, according to familiar rules. The preliminary application of a rubber bandage to drive all blood from the limb should be omitted in cases of marked infection and of injuries by cartridge wads or other likely tetanus carriers.

Ordinarily, local anesthesia is quite satisfactory for the hand and foot, and also, usually, for the removal of foreign bodies elsewhere in the muscles not deeply situated. Indeed, under local anesthe-

sia the patient is sometimes able to report to the operator when his dissection reaches the object sought. Surgeons vary in their preferences for the various anesthetic agents. There are several quite suitable, when properly employed. Cocaine, if used at all, should be in very dilute solution, since considerable infiltration may be necessary. Injections are made along the proposed line of incision, endermatically, and into the tissues beneath. For each extension of the operation beyond the anesthetized field, more of the solution is to be used.

There is a rule to make the incision at an angle to the long axis of the foreign body, and when the latter is quite superficial this hoary advice is good. When the object is buried more deeply, however, the incision should be made parallel to the underlying muscle fibers. (This plan should be modified

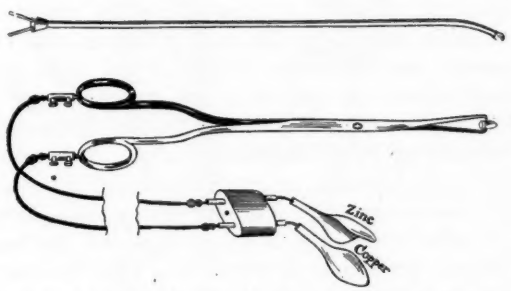

Figure 7.—Lilienthal's Electric Probe and Bullet Forceps.

only to secure the best drainage in the presence of suppuration). Unless the object has been definitely localized at some distance from the point of entry, this, when known, should be included in the incision, marking this spot for further reference by a little nick in the skin.

In the digits the dissection should be confined, if possible, to a quadrant bounded by the tendons in the median line and the nerve and bloodvessels laterally. While they cannot escape a careful search, small foreign bodies are sometimes surprisingly elusive even in these confined areas.

Sharp bodies entering the palm may penetrate between the metacarpal bones, but it is rarely preferble to attack them by a dorsal incision.

The skin wound retracted, the fascia is inspected. If the object lies wholly beneath, it is wise to at once split and widely retract it, for impact of the palpating finger with strands, especially of the tough plantar fascia, is very apt to deceive one. If the underlying muscle reveals nothing on palpation it is split, bluntly, along one of its gross divisions overlying the determined locus of the body. Exploration in this cleft is conducted by palpation with the tip of the index or little finger, and then under the eye with the muscle retracted. A closer search through the substance of the muscle is similarly executed by separating its fibers, *not by cutting them across*. Deeper muscles are to be explored (either because of the original localization or because the object is displaced by the palpation) in the same manner. Small vessels are tied before cutting them and large ones usually do not need to be cut. In the hand the field of search is very often just between the two palmar arches, and with care most foreign bodies can be extracted without injuring either of these structures. The assistant should use his retractors strictly under the operator's directions. An unsolicited movement with these or with a sponge may drive the foreign body from the field just as the surgeon has encountered it. At all stages the dissection should be thus precise and deliberate.

Figure 8.—Electric Magnet.

The eye and the finger tip are the best guides. The probe is here a deceptive instrument. Tense strands of tissue (vessels, nerves, fascia) feel, and small blood-filled veins look, like needle fragments. Picking and stabbing at these, and cutting into the muscles in the pursuit of each false clue, will effect a veritable hash of the tissues—which spells hemorrhage, suppuration, sensory paralysis and disturbed motility, and adds to the difficulties of a second search, since the first one, conducted in such a fashion, is often fruitless. If the operator loses his bearings, or fails to find the object within the field determined for it, far better than to continue an aimless search is it to submit the patient to a further *x*-ray examination, with one or more probes or needles inserted in the wound for orientation. This will redirect the surgeon in the proper path and the operation can thus be brought to a speedy termination.

When an extremity of the object is plainly felt, still no attempt should be made to extract it until it is bared of tissue. Splinters of hard wood, like pieces of glass, may become encysted in the tissues, and can often be drawn out whole by one end. But soft wood, and especially old wood, breaks on traction, and unless the wound is made large enough

to expose it all, even very large fragments may be left, unrecognized, in the tissues.

Toothed instruments are not suitable for the extraction of metal or glass. Anatomical- or dressing- forceps are more satisfactory. The "bullet forceps," still used as a volsellum, especially in gynecological work, has come down to us from the days of the lead missile and the blind search. The curette is occasionally needed when numerous glass fragments or metal filings are to be removed. A needle driven through the phalanx requires heavy forceps for its extraction, and sometimes the bone itself must be chiseled to free it.

For metal objects, especially if they be deeply buried in large muscle masses where landmarks are soon lost, certain instruments accessory to localization and extraction are occasionally helpful. One of these is the *telephone probe*. A telephone receiver is detached with its two cords. To the end of one of these a probe or exploring needle is fastened; to the other a sponge electrode, to be placed conveniently on the patient's skin. When the probe touches the metal object a distinct click or grating sound is heard in the receiver, held to the surgeon's or assistant's ear.

Lilienthal's electric probe (figure 7) consists of two segments, insulated from each other, each attached to a conducting cord. The tips of the segments are about one-sixteenth of an inch apart. The cords terminate in metal plates, one of zinc and the other of copper, which are held in the mouth, one on each side of the tongue. When the tip of the probe touches the metal a mild galvanic current is distinctly felt in the tongue. In Lilienthal's bullet forceps the two segments of the probe are replaced by the two blades of the forceps, one of them insulated except at its tip.

The telephone probe and the electric probe are alike in principle. In the first the battery is the patient's body, in the second, the surgeon's; in both the metallic object completes the circuit. In both, also, actual contact is required, and in both the probe is thrust about in the wound more or less blindly. These devices are, therefore, of limited service. If the object is not revealed by careful visual and manual search, it is usually more satisfactory to secure another x-ray exposure, with metallic objects placed in the wound for orientation.

One might expect, theoretically, at least, that a *magnet* would be useful in dealing with steel or iron bodies in the skeletal tissues. Actually, however, this, too, is of but little help. A magnet will not draw a needle, for example, through any tissue, at an angle to the long axis of the needle; nor will it withdraw a needle along its axis unless the instrument be powerful or the contact actual. A slender magnet will, to be sure, transmit to the operator's hand the message of contact with a needle—so will his finger; a magnet will extract a needle, not too firmly imbedded, if brought against an end of it—so will forceps.

In order to determine the usefulness of an electromagnet in removing steel and iron bodies from the skeletal tissues, I have very recently had the Electro-Surgical Instrument Company make for me an electro-magnet about twice the size and four times the strength of the eye magnet this company manufactures (figure 8). It is used with a controller and a 32-candle power light, in connection with the street current. The tips, of various size and shape, are sterilized by boiling, and the handle is wrapped in sterile gauze. In using the instrument one must so manipulate the tip that its point is not caught under a bit of fascia or muscle, for this imparts a sensation deceptively like that of contact with the needle; and, of course, retractors and other steel instruments must be kept a little distance away.

Thus far, my experiences with this electro-magnet sum up its possibilities as follows: Occasionally it may indicate or extract a needle in a recess not convenient to the finger or forceps; if a doubtful structure be seen or felt in a wound, the magnet will determine whether it is a vein, for example, or a needle fragment; it will be of assistance in removing steel or iron filings from an open wound. Perhaps further experimentation with the instrument may somewhat enlarge its sphere of usefulness.

The Dressing. If the foreign body had been long enough imbedded to insure its sterility, if the operation is brief, and the manipulation of the tissues slight, and if there has been no break in the technic of asepsis, no drain is needed. Since these conditions seldom all obtain, drainage is usually desirable, if only by a strip of rubber tissue or split rubber tubing. The muscle rarely, but the fascia sometimes, requires a few absorbent sutures. Silk sutures, sometimes adhesive strips, are used for the skin. Before removing the tourniquet, if an extremity has been operated upon, the parts are snugly enwrapped in rolls of gauze (over a flat piece covering the wound), and a bandage is firmly applied. If the tissues are infected, the gauze may be covered with gutta-percha, and a wet dressing applied after twenty-four hours.

For the fingers I have long since abandoned the classic bandage that covers all of the finger and extends back to the wrist. Instead I apply only sufficient bandage to hold the required dressing. The last turn of the roller is made at the proximal

end of the dressing; and here it is tapered by turning in the corners. A strip of adhesive plaster not over one-fourth of an inch wide, and about twice the circumference of the finger, is applied, not constrictlingly, once around, to hold the end of the bandage. Another narrow strip of plaster is passed up one side of the dressing, over the tip and down the other side, and its ends are held down by a second turn of the first strip (see figure 9). Such a bandage is less unsightly, less uncomfortable, less wasteful than that usually applied; it covers only as much of the finger as is necessary, and the exposed joints are unimpeded (the last a matter of no small importance). In private practice I use black bandages for the fingers, since they do not "soil,"

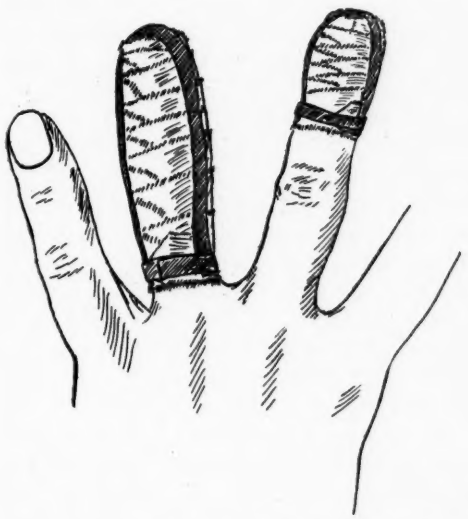

Figure 9.—Dressing of Fingers (or Toes), showing the arrangement of the adhesive plaster strips.

and fasten them with strips of black adhesive plaster.

The same bandage is applied to a toe, all of which, however, has to be included in order to secure the dressing. Although I have used this form of dressing a great many times, not once has it fallen off.

In the surgery of foreign bodies in the skeletal tissues thus far outlined, modifications are needed in certain conditions, to be briefly referred to.

Large bodies modify the treatment according to the damage they inflict. An entire skewer, or similar object, may be imbedded in the muscle without causing much injury. Large pieces of wagon shaft or fence rail, and large metal bodies escaping from a fly-wheel, do more or less violence to the tissues, and the treatment of the wound after their removal must be guided by the surgery of those injuries.

In removing a foreign body from a joint none but an uncontaminated gloved finger should be permitted in the wound, and that no more than is necessary. If the joint is infected it is irrigated with saline solution and drained. If the foreign body is aseptic (as the modern rifle projectile is apt to be) no irrigation is employed; the opening in the joint is sutured, and a drain is placed in the outer structures. An immobilizing dressing is applied.

When dealing with blank cartridge injuries, no consideration for the integrity of the muscles should limit the thorough exposure of every part of the wound; but the larger vessels should be, and the nerves must be, spared. Every particle of wad is to be removed—by forceps, curette and free irrigation. The wound is then swabbed with tincture of iodine, or with phenol followed by alcohol. Every cranny is drained with gauze; and an abundant wet dressing is applied. An injection of a prophylactic dose of antitetanic serum is a wise precaution here—as in any case where the possibility of this infection is feared.

In attempting to formulate the surgery of foreign bodies in the skeletal tissues, the writer has not been unmindful that correct technics can greatly simplify, but not altogether remove the difficulties inherent. He appreciates that a needle buried in the muscles often seems to the operator, for a time, as elusive as though it were in the proverbial haystack. But he is convinced that, if combined with a little patience, careful localization and a nice operation will lead to success; and that, unless combined with a great deal of luck, haphazard localization and a haphazard operation will lead to disappointment and disfigurement.

30 WEST 92D STREET.

PAPILLARY SYNOVITIS.

The fundamental cause of this condition is still extremely obscure. It is sometimes referred to under inflammatory affections, but it is not at all certain that the disease is really of that nature. By some it is considered to be allied to rheumatoid arthritis, and no doubt the condition is found in many rheumatoid joints; on the other hand, a most extensive papillomatous condition of the synovial membranes may be met with without any other sign of rheumatoid change in the joints, or without, as far as present experience goes, that condition supervening later.—C. J. RINGNELL in *The Journal of the Minnesota State Medical Association.*

THE OPERATION OF DIRECT BLOOD TRANSFUSION—DESCRIPTION OF A SIMPLE METHOD*

JOHN A. HARTWELL, M.D.,

Attending Surgeon to Bellevue Hospital; Assistant Surgeon to Presbyterian Hospital; Consulting Surgeon to Lincoln Hospital,
NEW YORK CITY.

A considerable period of time is always needed to determine the exact value of any new therapeutic measure. While the direct transfusion of blood in the human subject is a procedure which has been known to medicine and surgery for a great many years, its application has become general only in very recent times. One reason for this is, that by all the older methods a faulty technic was responsible for many deaths by embolus, and a second is, that the measure was superseded by the very simple and safe one of infusion with one of the saline solutions.

Infusion, however, does not meet all the indications, and therefore our debt to those experimenters and clinicians who have put transfusion on a sound basis is a great one. The operation as detailed by Carrel and Crile has now been in general use for two years or more, and the cases operated upon are sufficient in number to make their analysis a matter of importance.

The study of any surgical treatment comprises a consideration of its indications, its technic, its dangers, with the means of guarding against them, and finally its value in curing disease. With the indications for, and the value of blood transfusion, we shall not deal at this time, except to say that the experience of the last two years shows that there are manifold pathological conditions in which it seems indicated, and which to a greater or less degree have been favorably altered by it. After the lapse of another two years we shall be in a better position to arrive at definite conclusions as to when it may be safely used with the hope of positive benefit.

This paper deals with the technic of direct blood transfusion and its dangers, with the means of guarding against the latter. The improved method of end-to-end suture of the donor's artery and the recipient's vein as practised by Carrel, gives perfect results in animals, and has been used with success in the human subject. It is an operation, however, of very difficult execution, and in the hands of many surgeons has failed because of the formation of a clot. Its success depends on the most rigid asepsis—Carrel and Sweet attributing the failure usually to an error in this—and a most careful attention to every detail. The employment of the greatest gentleness in handling the vessels is a sine qua non. The needles used are so fine as to tax the sight and the tactile dexterity of the most expert. The silk must be carefully selected, of the same caliber as the needles, and it must be soaked in vaselin. To surmount the difficulties inherent in this operation, an extensive experience on animals is necessary, and even then the surgeon finds his first case in the human subject a cause for congratulation if he succeeds.

These considerations have led to an effort to find some simpler method for the vascular union, and a number of different mechanical devices have appeared. Crile modified the canula of Payr by attaching a handle to it, and circumscribing it with small rings for the better holding of the ligatures. It was the publication of his results which gave a new impetus to the use of the operation. The method is ideal in that it brings the normal intima of the vessels in contact without the interposition of any foreign body. This does away to some extent with the danger of clotting. There is an objection to it, however, in that the lumen of the vein is constricted by the thickness of its wall where it is cuffed back over the end of the canula. If a large enough canula is used to make this a matter of no consequence, the artery is often too small to be easily drawn over the canula and the turned back vein. To overcome this drawback, some operators have passed the artery through the canula and turned this back, placing the vein on the outside.

The greater thickness of the arterial wall, however, still more constricts the lumen, and the delivery of blood through it is hardly larger than a pin in diameter when the radial artery is used. Unless the slack in the vessel where it passes through the canula is completely taken up, a still greater lessening of the caliber results, and may even stop the flow altogether.

None of these objections holds in the dog, because the carotid artery and the jugular vein are both thinner, and of larger caliber than the vessels available in man. A consideration of the results obtained in the series of cases here presented, and the numerous modifications of the canula which have appeared during the past year, many of which have not yet been described in the literature, are ample testimony that some further simplifica-

* Read before the N. Y. Academy of Medicine, Section on Surgery, January 8, 1909.

tion is needed before the operation will be an accepted one in the hands of surgeons at large.

In the preparation of this paper, a circular letter was addressed to fifty-two surgeons connected with the various hospitals in New York City asking for their experience with the operation, and permission to quote it. Replies were received from forty-five, and to them the writer here wishes to express his indebtedness. Their names will not appear because many of them are desirous of publishing their cases in full at a later date. Of the forty-five, twenty-seven had no experience, and eighteen have done the operation one or more times, seven being the greatest number reported by any one surgeon. The total number of operations recorded is forty-three, which, with five done by the writer, gives forty-eight from which to draw our conclusions. Of this number, only six were done with the suture. Two of these were done by the writer with partial operative success; that is, a certain quantity of blood entered the vein, but clotting took place before all that was desired had passed the anastomisis. In the other cases, failures are recorded because of immediate clotting.

Forty-one were done with the canula. Twenty of these, practically one-half, were recorded by the operator as either failures or only partial successes; that is, there was either no flow of blood, or a less quantity than was desired. In twelve of the twenty no flow whatever took place. The cause of a lack of success was due usually to clotting of the blood, though in one case the radial artery contracted so tightly that no blood would flow through the unimpeded cut end—a condition which Crile has noted. The remaining case, done by the writer after the method to be described, was a success. The time during which the blood was permitted to flow, after the anastomosis was complete, was from twenty minutes to about one hour. The fact that more than forty-five minutes is ever required proves that the flow must be very small, otherwise the donor would become exsanguinated. In a number of the cases there was a great difference of opinion among those assisting at the operation, as to whether the blood was flowing or not, and if so, whether it was free or impeded. This is due to the fact that the small stream delivered into the artery does not distend the vein. It would seem an easy matter to temporarily obstruct the artery, empty the vein by milking it toward the heart, and then with the cenral portion of the vein obstructed, note whether it fills on releasing the artery. Any one who has tried it, however, will be struck by the doubt in his own mind in many cases.

The majority of surgeons from whose cases the above facts were obtained, expressed themselves as of the opinion that the operation should be classed as one of especial difficulty. A few, however, had no trouble with it, and were successful in all the cases they had operated upon. The writer's experience was not a satisfactory one.

In Case I the donor was a healthy young man of robust build. The recipient was suffering from the results of secondary hemorrhage and sepsis. The Crile canula was used, and an apparently satisfactory anastomosis was made with no especial difficulty. Close inspection of the vein seemed to demonstrate a flow of blood into it, yet there was no evidence of loss of blood by the donor at the end of fifty minutes. The vein was then cut centrally to the canula and no blood was flowing. The subsequent condition of neither participant indicated that any great quantity of blood had been transfused.

Case II. Sarcoma of the leg in a boy of 16 years. Refused amputation. Donor, healthy man. Suture method. In this case some blood undoubtedly flowed into the vein, as indicated by a positive and negative change in blood pressure in the donee and the donor respectively. It was, however, unsatisfactory, and at the end of fifty minutes the vein was cut, and a clot found in the anastomosis, but not completely occluding the lumen.

Case III. Same as case II. Three weeks later, suture method, satisfactory. All agreed that a good stream of blood flowed for thirty minutes, and there was a rise of blood pressure in the donee of 20 m.m. and a corresponding fall in the donor. On testing the anastomosis, however, by cutting the vein, at the end of fifty minutes, only a dribbling stream of blood was found to be passing through it.

Case IV. Woman. Severe anemia. Patient of Dr. Freeman of Orange. Donor, the husband. Buerger canula used. Great difficulty experienced in making a satisfactory anastomosis, various factors, which a larger experience would remedy, contributing. All who took part in, or watched the operation, except Dr. Freeman, were of the opinion that the blood flowed for a considerable time. But no material change in either blood pressure or hemoglobin of the patient took place, and the case cannot be considered as a successful one. In the two cases where the canula was used by the writer, the artery was passed through the canula. They cannot therefore fairly be counted as failures with Crile's method. This was done because of the diffi-

culty in getting the artery over the canula as above mentioned.

These four experiences, and many of those cited above, which had been verbally reported to the writer by the operators, led to an attempt to devise some simpler and more certain method for the transfusion of blood, and it is that method which is here presented for consideration. It has the advantage of needing no special instruments, and no unusual skill in operating. It delivers a free stream of blood which is easily controlled, and is, we believe, free from danger.

The radial artery of the donor is dissected out for a distance of two inches, or more if convenient, under cocain anesthesia; the small branches are isolated and tied, and a ligature is thrown around the distal end, but not tied. The wound is covered with a moist, warm pad. An accessible vein in the forearm of the recipient, below the bend of the elbow, is similarly exposed for the same length. If possible, a small tributary is dissected free for one inch at some point central to the proposed site of anastomosis. This is loosely clamped at its distal end. A ligature is then tied around the distal end of the main vein, and the vein divided just central to it. If needed, a light obstructing clamp is put on the vein higher up, but it is not always required. The adventitia is carefully stripped from the cut end of the vein as described by Crile, and three sutures of fine silk, impregnated with vaselin, are passed through the media and intima at a distance of 120 degrees on the cut circumference of the vein. The wound is then covered with a moist warm pad. The silk need not be finer than the ordinary No. O, and the usual fine round intestinal needle answers every purpose. The artery ligature is now tied, an obstructing clamp gently placed on its central exposed part, and the artery divided with sharp, fine scissors just above the ligature. The adventitia is removed from the cut end, and then a small roll of it is slid upward along the artery, for a distance of an inch or more, and left attached. Through this a silk suture is passed, tied, and cut about half an inch long. If possible, a small branch of the radial, at about one inch from its cut end, may be left long enough to take the place of this roll of adventitia. The artery is then immersed in liquid vaselin, and by means of a small forceps, gently grasping it at about one inch from its cut end, it is passed directly into the mouth of the vein, which is held open with the three sutures. The arterial wall is sufficiently rigid to make this step very easy. One, or if need be two, of the venous sutures are then clamped either to the suture in the adventitia, or to the radial branch, in order to prevent the separation of the two vessels, and the excess of venous circumference clamped so as to snugly hold the artery, but not to constrict it. The obstructing clamps are then removed, and the flow proceeds.

Crile has called attention to the danger of overburdening the right heart, if the blood flows too rapidly, and one case in this series suggests its having happened. Digital pressure on the artery controls absolutely the rapidity of the flow. If there is at any time a question of the success of the transfusion, the clamp from the venous tributary is removed, when the arterial blood will be seen to spurt from the cut end. Experiments on dogs show that there is no tendency for fringes of clot to form around the cut end of the artery if it is well coated with vaselin. One precaution which can be more readily observed here than in the use of the canula or suture method, is the avoidance of air emboli. Both artery and vein can be filled with fluid blood just prior to the anastomosis, by removing for a second the obstructing clamps. The method has now been used many times in the dog with great ease and perfect success. The only opportunity to use it clinically was in Case IV, when it was done four days following the first attempt. It was very easy of execution. A small radial branch was used for clamping the vein suture to, as well as the roll of adventitia. The tributary vein was accessible, and an arterial spurt of blood several inches high would pass through it when the full force of the radial flow was allowed to enter the vein. This indicator is of great value when it can be used, because it at once dissipates all doubt as to the patency of the anastomosis. On this occasion the radial artery was controlled by digital pressure for fear of overburdening the right heart. The anastomosis continued for forty-five minutes and was then still very efficient, as shown by the venous indicator.

The order of procedure given above, that is, to first expose the artery, but not clamp or cut it, then to prepare the vein, and finally come back to the artery, is advisable. The first step is done on the donor, and if desirable, the patient proper need not be present until it is finished. The reason that it is inadvisable to complete the arterial work then is that the longer clamping and exposure of the artery, while the vein is being prepared, may help to bring about its contraction so as to conclude the blood flow. The changes in the condition of both the participants was in marked contrast to those observed on the first occasion, demonstrating the

loss of all the blood the donor could lose—in fact, more than he could safely lose as noted below.

A modification of the above method has been performed in dogs by passing the artery into a longitudinal slit in the wall of the vein. It is very easy of accomplishment in this animal in which the artery is much less rigid than in man. No opportunity to try it clinically has yet occurred.

Beside the actual method of performing the anastomosis, a second factor in the technic of the operation is important, namely, some method of actually estimating the amount of blood transfused. Various means have been tried to indirectly determine this by observations on the condition of the donor and donee. Estimation of the hemoglobin is one of these. The hemoglobin of the donor will not materially change during the operation, because in so short a time the fluid is not sufficiently absorbed to show the true loss in hemoglobin per cent. An increase in the hemoglobin of the donee shows an undoubted successful transfusion. There is no close relation, however, between the increase in coloring matter and the actual amount of blood received. It would seem possible, if we knew the hemoglobin content of each participant to start with, the total amount of blood in the donee, and the hemoglobin per cent. of the latter at the end of the operation, to work out, by formula, the amount of the donor's blood required to give the increase in hemoglobin noted. Each of these factors can be determined, the hemoglobin by the colorimetric test, and the blood quantity by the carbonic oxide test of Haldane and Smith. Some experiments are being done now by the writer to prove the efficiency of this method. So far as yet determined, however, certain unknown factors seem to enter into the problem which will vitiate the obtaining of accurate results. Enough has been already done to show that nothing can be learned by using the estimate of one fifteenth of the body weight in dogs as giving the weight of blood. This is the average as determined by many observations, but the individual variation is so great at to vitiate the findings. In man, Haldane and Smith found a variation from one-twenty-fifth to one-sixteenth, with an average of one-twentieth of the body weight as representing blood weight, using normal individuals of average nutrition. In unusual nutritious conditions and disease the variation is still greater. The variations in the number of corpuscles, red and white, is open to the same objections.

A second method for determining the amount of blood transfused is to note the alterations in blood pressure and pulse rate in the participants. The unknown factors here are obviously too great to give any accurate knowledge, though a marked change in these functions indicates a successful transfusion.

A third method is by weighing the participants before and during the operation. This would require a specially devised scale of great delicacy on which the operating table could be fitted. Such a scale is not available for general use. Weighing before and after the operation would, of course, give very accurate data concerning the point in question, but what is needed is a method which can be applied during the operation.

Using the method described in this paper, it may be possible to uncouple the vessels, lift the donor on the scales, weigh him, and, if indicated, replace him on the table and reunite the vessels. This whole procedure would not require more than five minutes and the ordinary scales would answer every purpose.

A fourth method is that of measuring in a measuring glass, the blood which flows from the donor in a given time, and estimating from this the amount flowing into the vein after anastomosis. This fails because many variations in the rate of flow occur after union of the vessels. Tests made in the laboratory showed that the flow before anastomosis is much greater than that after anastomosis.

At present, then, we have no accurate means of determining the actual quantity of blood used. We must depend on all the above methods, and be guided by general considerations of change in hemoglobin, cell count, pulse rate and blood pressure, for determining when the donor has given all the blood which is within the limits of safety.

Continuous enteroclysis should be given to the donor during the operation, or a saline infusion at its termination. In one case, that in which the artery-within-the-vein method was used, it was thought we were well within a safe limit, but a rather severe condition of collapse occurred four hours after the operation.

The dangers to the recipient attending the operation fall under four heads: first, a hemolytic action of one blood on the other; second, the entrance of blood or air emboli into the circulation; third, the use of a donor who has some undemonstrated communicable blood disease; and fourth, overdistention of an enfeebled right heart. The question of the first danger—hemolysis—is one which must be constantly borne in mind in the operation of transfusion. Where sufficient time can be taken for

testing this, it should never be omitted, because *à priori* it is not safe to conclude that in any case corpuscular destruction will not take place. When the operation is done for a hemorrhage occurring in a previously healthy person, the danger of hemolysis is undoubtedly small, and the urgency of the case may contraindicate any delay for testing the two bloods. But in all pathological conditions of the blood, the disintegration of the red corpuscles may be very great. In one case in this series, death resulted in a few hours after the transfusion, from very extensive hemolysis. Patients with primary and secondary blood diseases, and sepsis, seem particularly liable to this accident.

The second danger, the possibility of a clot or an air bubble washing away from the site of anastomosis and producing an embolus, must not be lost sight of. There is no positive record of its having happened in this series, but in one case the symptoms suggested this as a probability. Care in the technic is the only safeguard we have against this, and further experience may show that it will happen even in spite of such care.

The third danger, that of using a donor unfit for the purpose, ought never to be in actual evidence with proper care. Too great hurry in a desperate case might, however, lead one into such an error.

The fourth danger, that of injuring the right heart, has already been considered, as has the means of avoiding it.

The operation is without danger to the donor unless, in our, and possibly his, desire to help the recipient, we carry on the transfusion for too long a time. His discomfort will, however, be less if we replace immediately the blood lost by normal saline solutions.

While this paper includes only a study of unpublished cases placed at my disposal by the operators, and my own experience, it may be proper to say one word concerning the cases reported. Thirty-eight of these have been analyzed, practically all of which were done with the canula. The results are almost invariably favorable so far as the success of the technic goes, only four unsatisfactory results having been recorded. One reason for this is found in the fact that nearly all the reported cases have been done by men with a very large experience in animal surgery, and in the hands of such men any method will prove successful. Again, our failures are less urgent than our successes in the matter of publication.

Conclusions:

1. The operation of direct blood transfusion as practiced with suture and canula shows a large per cent. of unsatisfactory results. It requires special instruments and unusual skill for its successful execution.

2. The direct entrance of the artery into the vein in a large series of experiments and in one clinical case.

3. At present we have no means of obtaining accurate knowledge of the quantity of blood entering the vein. The changes in hemoglobin, red cell count, pulse rate and blood pressure must all be given weight in estimating this quantity. Actual weighing of the donor may solve the problem.

4. The operation is not without danger from hemolysis, embolus or overdistention of the right heart, but with proper care these should be avoidable.

In closing, the writer wishes to express his thanks to Dr. Jameson for aid in the preparation of the paper, and to Drs. Wheelwright and Cooke and Mr. Cowan for aid in the laboratory.

All the animals used in the work were fully anesthetized with ether.

50 EAST FIFTY-THIRD STREET.

THE AVOIDANCE OF HEMOLYSIS IN TRANSFUSION.

MARTIN REHLING, M. D.,

Adjunct Visiting Surgeon, German Hospital, New York City,

AND

RICHARD WEIL, M.D.

Assistant in Experimental Pathology, Cornell University Medical School,

The practice of the transfusion of blood in human beings has attained a considerable degree of prominence within the last two years, owing to the improvements of surgical technic introduced by Payr of Graz and Crile of Cleveland. These transfusions have in a number of instances been succeeded by very alarming symptoms, and even by the death of the patient. A typical case of such a death is recorded by Pepper and Nisbet. The patient was a man of 33, suffering from "some obscure type of hemorrhagic disease." His hemoglobin was 20 per cent., his red cells 970,000. He received a transfusion from donor A, which improved his blood, and appeared to benefit him. Two days later, he received another transfusion from donor B. This was immediately followed by a rise of temperature, jaundice, hemoglobinuria, and swelling of the spleen. After five days he died. Other cases are reported

by Watts, Crile, and others. In none of the recorded cases were any tests made to determine the compatibility of the two bloods, preliminary to the performance of the transfusion.

We desire to contribute an adidtional case of hemolysis due to transfusion, and to indicate the precautions necessary to avoid that result. The clinical features of this case will be described in detail in a subsequent article by Dr. Rehling.

The patient was a man twenty-seven years of age, suffering with splenic anemia. His blood count showed 1,840,000 red cells. The hemoglobin, as estimated by Tallquist's scale, was 10 per cent., as estimated by Fleischl's hemoglobinometer, 15 per cent. Preparatory to splenectomy, it was deemed advisable to transfuse the patient. A preliminary test of the blood of the patient and of that of the intended donor indicated, as will subsequently be described in detail, a slight tendency of these two bloods, when mixed in the test tube, to undergo hemolysis. In spite of this fact the transfusion was performed. The rather small radial artery of the donor was connected with the median cephalic vein of the patient, and the flow was allowed to continue for sixty-five minutes. At the end of this time the patient developed a severe chill. The hemoglobin of the patient, as measured by Fleischl's instrument, had been increased to 24 per cent. when the operation was finished. One hour after transfusion, the patient passed about 150 cc. of dark blood-stained urine. After this, he passed urine at frequent intervals for 12 hours, during which time the degree of bloody discoloration gradually diminished. After 12 hours he passed no more bloody urine. The examination of this urine revealed the presence of albumen; no red blood cells microscopically; and, chemically and spectroscopically, a heavy admixture of hemoglobin. Four days after transfusion the hemoglobin had sunk to 21 per cent. according to Fleischl's hemoglobinometer. Splenectomy was then successfully performed.

The especial value of this case lies in the fact that it affords clinical evidence of the reliability of the laboratory reaction which was made to determine the compatibility of the two bloods involved. Indeed, although the result of the reaction was positive in only a slight degree, the clinical result demonstrated that such slight results must be regarded as serious warnings, or, rather, as indicating the employment of a different donor. The test was performed as follows: Five cubic centimeters of blood were aspirated from one of the veins at the elbow from each patient. Of this blood, one cubic centimeter was expelled into a tube containing four cubic centimeters of a one per cent. solution of sodium citrate. The remainder was passed into sterile test tubes and allowed to clot. The citrated blood, which does not clot, was centrifugalized in graduated tubes, and the corpuscles were washed four times by successive centrifugalizations in fresh salt solutions. The object of this procedure is to remove the last traces of native serum. After the fourth centrifugalization, the cubic volume of the centrifugalized cells, as determined by the graduations on the tube, was noted, and the cells were suspended in fifty times their volume of isotonic (0.85 per cent.) salt solution, giving a four per cent. suspension. From the tubes containing the clotted blood, serum was poured off. The test was performed in the following manner. The serum of each individual—donor and patient—was tested against the corpuscles of the other, one cubic centimeter of each being used. In addition, the red cells of both donor and patient were separately tested, as controls. Eventually, there were four test tubs, as follows:

1. One cc. of the patient's serum, plus one cc. of the donor's red cells;
2. One cc. of the donor's serum, plus one cc. of the patient's red cells.
3. One cc. of the suspension of patient's red cells.
4. One cc. of the suspension of donor's red cells.

These tubes were subjected to the temperature of the incubator (100 degrees F.) for two hours, and then placed in an ice-chest over night. The presence or absence of laking was noted the following morning.

It was found in this case that tube number one showed a slight degree of laking, indicating that the serum of the patient was capable of destroying in the test tube a certain number of the corpuscles of the donor. If the figures be analyzed, and expressed in terms of the whole blood, the result would indicate that two cubic centimeters of the patient's blood, when diluted with an equal volume of salt solution, was capable of destroying a portion of one-tenth cubic centimeter of the red cells of the prospective donor, when diluted with twenty times the volume of the latter in a mixture of salt solution and serum. It is evident that it is somewhat of an assumption to argue from a test tube reaction of this character to the probable result of a transfusion. This assumption will be analyzed in detail later on. For clinical purposes it had been assumed by us that the test tube reaction could be accepted as a guide to the results of the transfusion. In a

series of eight previous tests of this character on the bloods of patient and donor, no hemolysis had ever been noted, and there had been no clinical evidence of hemolysis after transfusion. In this case the presence of so slight a reaction seemed to offer no sufficient objection, and the transfusion was performed. The result has already been described.

In view of the intra vitam confirmation of the reaction in vitro, it may be interesting to indicate the limits of validity in the inferences drawn from the latter to the former. It may at once be admitted that the use of the serum and of washed red cells introduces a set of factors totally different from those maintaining in the body; neither serum nor washed red cells, as such, actually enter into the reaction when a transfusion is performed. Unfortunately, it is impossible to avoid this difficulty, and, as will be subsequently shown, it does not actually invalidate the result. The second possible objection lies in the fact that the proportion in which serum and blood cells are mixed does not duplicate that in which the mixture occurs at transfusion. This is a factor of error which cannot be eliminated; moreover, it can only affect the degree, and not the quality of the reaction. Finally, the dilution of the patient's serum with an equal quantity of salt solution, by the introduction of an equal quantity of the red cell suspension of the donor, introduces a factor entirely foreign to the transfusion. This has been obviated in more recent work by a procedure employed by one of us (Weil) in routine work on hemolysis, namely the use of a 20 per cent. suspension of red cells, which makes it possible to dilute the serum of the patient with only one-tenth cubic centimeter of the red cell suspension. This certainly makes a closer approximation to the conditions which maintain in transfusion.

It may be stated that it would be an even greater refinement in technic, and a closer approximation to the vital conditions, if the red cell suspension used in the test were made up with their own sera instead of with salt solution.

It now remains to consider the justifiability of an inference from a reaction performed with serum and washed cells in the test tube, to the resultant of a mixture of the whole bloods within the bloodvessels. It is evident that there can be only an empirical justification for such an inference. Several years ago, when the procedure of transfusion was first introduced, a series of experiments was done by one of us (Weil), in conjunction with S. P. Beebe, to determine this point. It had been shown that the serum of dogs with advanced lymphosarcoma was frequently hemolytic for the washed red cells of normal dogs. An animal possessing a serum of this character was transfused with the blood of a normal dog, whose corpuscles had been shown to be destroyed by the serum of the former in vitro. No hemoglobinuria resulted. On the other hand, for several days the urine of the recipient was intensely stained by urobilin, which was interpreted as indicative of a heightened destruction of the red cells (pleiocholia). The same result was repeated in a second case. Recently one of us (Weil) has tested the assumption in another manner. A segment about four inches long of the external jugular vein of a dog was segregated by ligatures at both ends, the blood not being removed from the vein. An injection of one-half cubic centimeter of eel serum was then made into the vein by means of a hypodermatic syringe. Eel serum, it should be premised, is intensely hemolytic for the washed red cells of the dog in the test tube. After four hours, the blood was aspirated from the vein, drawn into a citrate solution, and imediately centrifuged. The supernatant plasma was markedly stained with hemoglobin, while the control blood, drawn from a vein treated in the same way except for the injection of eel serum, showed no change. In two subsequent experiments, the vein was treated as described, but into it was injected, instead of eel serum, the blood of a cachetic dog suffering with lymphosarcoma, together with a small amount of sodium citrate to prevent clotting. As a control, injections of the blood of a normal dog were made into the opposite vein. In the former case the supernatant plasma after centrifugalization was distinctly tinged with hemoglobin; in the controls this did not occur. It is evident, therefore, that to some extent the same reactions occur with the whole blood as with the serum and washed corpuscles.

To sum up, the test tube reactions, in spite of the differences in conditions, appear to afford a reliable criterion of the results of the intended transfusion. This fact has been verified experimentally on dogs, and once in a human case. It seems advisable, therefore, that every transfusion should be preceded by such tests.

MILD APPENDIX CATARRH.

Recent work has shown that mild grades of inflammatory change in the appendix are of extreme frequency. Krönig, who systematically removed the appendix at every laparotomy, found that in only 50 per cent. was it absolutely normal.—EVERETT O. JONES in *Northwest Medicine*.

FIBROSIS UTERI AND ITS SURGICAL TREATMENT BY A NEW METHOD OF VAGINAL HYSTERECTOMY.

SAMUEL W. BANDLER, M.D.

NEW YORK CITY.

There is a condition of the uterus, to which I have given the name fibrosis uteri, characterized by a diffuse fibrotic change in the entire thickness of the uterine wall and in the cervix, as a result of which the uterus is elongated, wider and thicker than normal. This fibrotic alteration is recognized during operation by the fact that the volsellum forceps, when grasping theu terine wall, break through it because of the brittleness of the tissue, and the pale pinkish yellow color of the broken areas resembles in every particular the appearance noted in fibroids in the uterus.

Microscopic sections show the muscularis to be invaded by regular and irregular bundles of fibrous connective tissue, so that in many areas this tissue fills the entire field of observation. Arteries and veins are very much dilated, their walls are thickened, and frequently the intima shows alteration of a typical nature. The contractility of the muscle fibres is altered, the interstices have been filled by this new growing tissue, and combined with this is a disappearance of the numerous elastic fibres of the uterus. The uterus has lost it's contractile power, the vessels have been affected in a like manner and the added loss of the contractile force of the elastic fibres tends to a ready bleeding from the uterine mucosa and to diminished ability to control this bleeding.

The pre-menstrual congestion which takes place throughout the whole genital tract and especially in the uterine wall and in the mucosa normally to a climax slowly and steadily. The final result of the congestive climax is the outpouring of blood. The normal uterus with well conditioned muscle fibres, with elastic connective tissue, and with elastic capillaries, resists for a period of twenty-eight days this congestion which ends in the expulsion of blood. Such a uterus limits the hemorrhage within the course of four or five days by the contractility of the muscular fibres and of the elastic fibres and of the capillaries.

If the muscular fibres, the elastic fibres, or the capillaries have lost, to a lesser or greater degree, their ability to contract or their ability to resist the congestive influence of the pre-menstrual period, bleeding either comes on sooner, or, when it comes, lasts longer. This, of course, implies well functionating ovaries producing the congestion which characterizes menstruation. The vast majority of these cases show ovaries which are large and plump. They evidence numerous follicles and possess the full power of the ovarian secretion to promote pelvic congestion. As a result of structural fibrotic uterine changes, since the ovaries are functionating, the menstrual congestion results in increased frequency of menstruation, in increased loss of blood and in increased duration of the menstrual function. In many cases menstruation is no longer regular, passing from the type of menorrhagia to the type of metrorrhagia. Most of these cases of fibrosis occur in women in the late 30's and in the early 40's. These women are stout

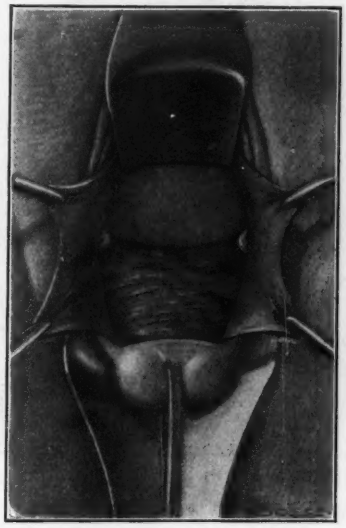

Figure 1.

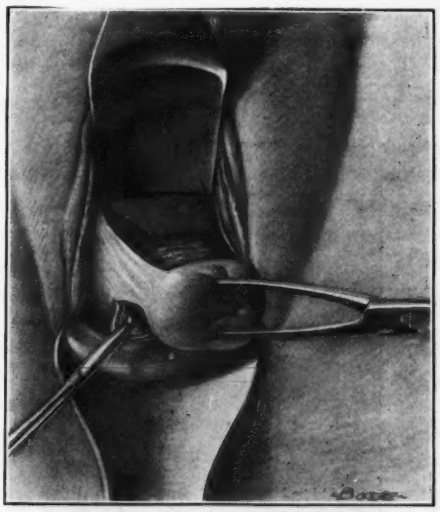

Figure 2.

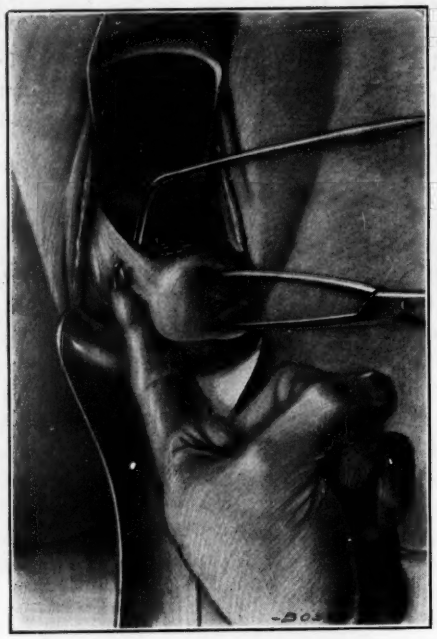

Figure 3.

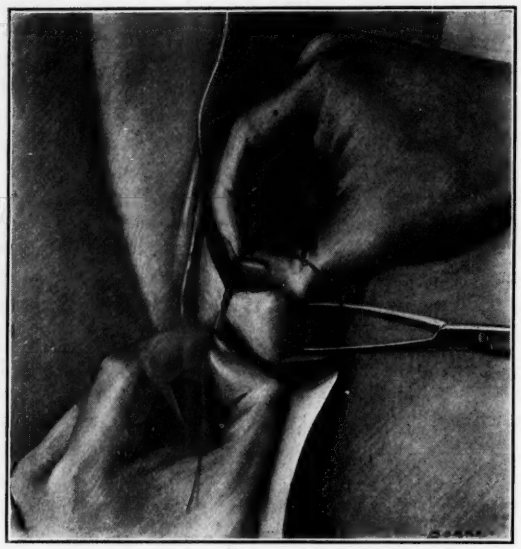

Figure 4.

and well built, and the menopause, if allowed to come of its own accord, may only result after the lapse of many years.

As a result of the increased loss of blood and the tendency to the formation of clots, the blood does not find ready exit through the cervical canal, the walls of which are hard and fibrotic, and painful menstruation is a very frequent complication. Nervous phenomena of pronounced type are among the annoying symptoms. There occurs in many cases what may be known as constitutional dysmenorrhea. For several days before menstruation and during the menstrual period, congestion involves the entire nervous system, the various mucosae of the body, and produces a sensation of fulness in the head, dizziness, nausea, anorexia, irritability, palpitation of the heart, restlessness and sleeplessness. These annoying symptoms, the painful menstruation and the great loss of blood often reduce these patients to a state of marked physical and nervous asthenia. While in many instances this uterine and constitutional condition results after two or three cases, in the majority of cases there is a history of frequent labors and often of several abortions. In all probability the element of subinvolution after frequent labors or abortions, plus the associated congestion resulting therefrom are the

Figure 5.

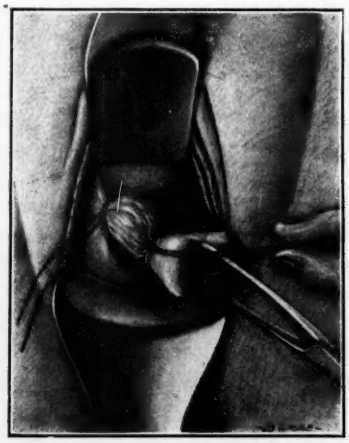

Figure 6.

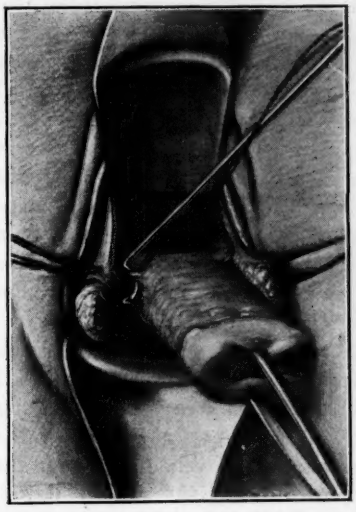

Figure 7.

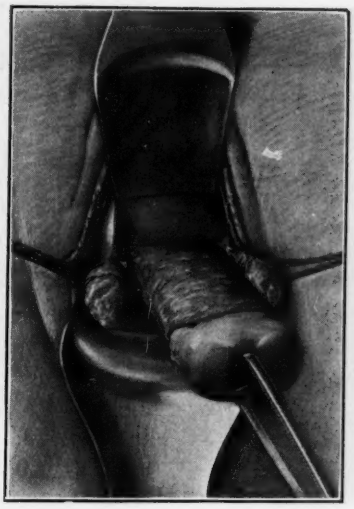

Figure 8.

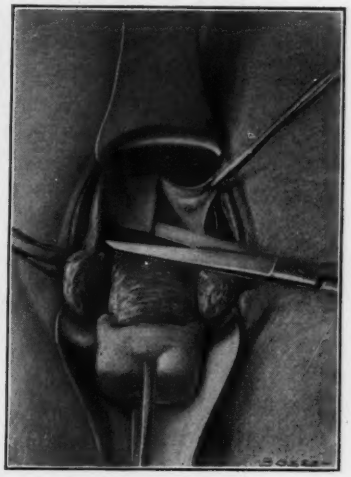

Figure 9.

etiological factors which lead, after the lapse of several years, to fibrotic structural changes in the tissue elements which make up the uterine wall. Prolonged congestion in the pelvis, altered circulation in the uterus and adnexa, and a general state of inelasticity are associated factors. There seems to be in certain women a tendency to an alteration of the normal elastic fibres of the uterus and their replacement by fibrous connective tissue, a condition which was well illustrated microscopically by the investigations of Pick. The uterine mucosa is, as a rule, in these cases not hyperplastic, so that endometritis *per se* is not an important point in the causation of these prolonged profuse bleedings.

The medical treatment of this fibrotic alteration of the uterus includes anything which may increase the contractile power of the uterus, which may diminish the size of the uterus, which may diminish the congestion in the uterus and in the pelvic structures. Among the drugs which are of value are the various preparations of ergot, adrenalin, etc. Among the therapeutic measures are the intra-uterine use of the positive electrode, the use of short, hot douches, the regular and systematic daily use of sitz baths of such temperatures as tend to permanently diminish the pelvic congestion.

Among the milder operative procedures are to be included very thorough curettage, and the use of steam with or without the preliminary use of the curette. With any of these various combinations plus rest and the avoidance of exertion, particularly before and during the flow of blood, many of these patients may be so markedly improved after months or years, that further intervention may be avoided. In many of these cases, even after temporary improvement of various durations, the trying annoyances recur. In a goodly proportion of cases the patients belong to that social scale which precludes the possibility of rest and the avoidance of exertion. Thereby one of our most important therapeutic measures is denied us. In other cases, the patients find that the treatment which is necessary and the rest which is demanded interfere too much with their family and social obligations, and prevent the leading of a life which is pleasurable and enjoyable.

The remedy which absolutely prevents the various combinations of symptoms is vaginal hysterectomy without removal of the ovaries. In this way unbearable hemorrhage is prevented; and the regular or irregular recurrence of the condition known as constitutional dysmenorrhea is at an end. (*Retention of the ovaries avoids the occurrence of constitutional symptoms of the climacterium.*)

Operation:—The following method of simple vaginal hysterectomy has been practiced by me in over 110 cases without a fatality:

The cervix is grasped by a heavy pair of volsellum forceps and is pulled forward so that its posterior wall is exposed. A transverse incision is made through the vaginal mucosa about an inch above the external os. The upper margin of the incision is grasped by a long mouse-toothed forceps and a pair of scissors dissect off the vaginal mucous membrane by short snips passing through the connective tissue bands which connect the vaginal mucosa to the structure of the cervix. A long pair of artery forceps than grasps the upper margin of this posterior

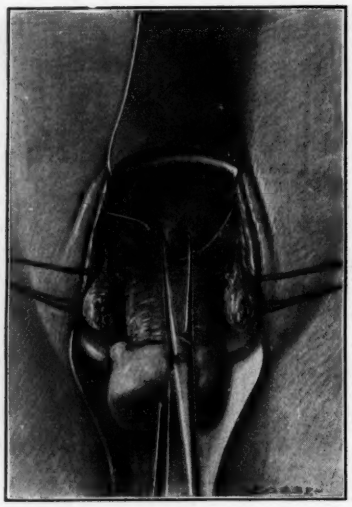

Figure 10.

incision and the finger separates the vaginal mucosa and the connective tissue still further from the cervix until the cul de sac of Douglas is distinctly felt. The cul de sac of Douglas is then perforated with the index finger, the finger is introduced into the peritoneal cavity and the peritoneum is hooked by the finger tip and brought down so that a long pair of forceps placed at the lateral margin of the incision unites the peritoneum with the edge of the vaginal mucosa. The same thing is done on the other side, so that the peritoneum and vaginal mucosa are held together at the lateral borders of the primary incision. These two forceps are of importance in that each limits the bleeding to a marked degree and serve to mark a point around which one of the final closing sutures is passed. The next step consists in making a transverse incision on the anterior wall of the cervix, the ends of which almost, but not quite, join the ends of the posterior incision. Two artery forceps are applied to the middle joint of the upper lip of this incision and by traction the connective tissue bands which unite the bladder to the anterior wall of the cervix are brought into relief. Some of these are cut with snips of the scissors, and then the index finger, covered with gauze, separates the bladder from the anterior wall of the cervix and uterus up to the vesico-uterine pouch of peritoneum. The two artery forceps being then put upon the stretch, a pair of long sharp pointed scissors is introduced between the vaginal mucosa and the bladder and the anterior vaginal wall is progressively incised for a longitudinal distance of 3½ to 4½ inches. Each artery forceps is then grasped in turn and with a slight rotation the vaginal mucosa is everted, a few snips with the scissors start the separation of the bladder from the vaginal mucosa and the subsequent complete separation of the bladder from the vaginal wall is carried out with the index finger covered with gauze. These steps are the same as those in the performance of vaginal celiotomy or vaginal fixation for prolapse of the uterus. These steps being completed the bladder itself is held back by a retractor. In a fair proportion of cases the uterine artery can be seen on either side after thorough separation of the bladder. (Figures 1 and 2.)

A ligature needle threaded with large sized silk is then passed through the lower border of the broad ligament close to the uterus and below the pulsating artery (Figure 3). This silk passes out through the posterior incision, and is tied very firmly over the uncut lateral border of the vaginal mucosa. Before tying this silk a slight snip is made in the vaginal mucosa to furnish a groove in which this ligature and its knot may rest to prevent slipping in the course of the subsequent manipulation (Figure 4). The long retractor which pushes the bladder upwards makes it easy for the uterine artery to be seen just above the first silk ligature that has been passed; so the second silk ligature is passed just above the uterine artery which is usually exposed to the eye (Figure 5), and the end is brought out through the posterior incision, and the ligature tied one inch above the first one (Figure 6); another groove being made in the vaginal mucosa with the scissors to prevent slipping of the ligature. The same procedure is then repeated on the opposite side after which a pair of scissors cuts between the fastened silk sutures and the lateral borders of the uterus, sticking very close to the cervix.

The scissors cut up toward the uterine artery. Very short snips should be taken so that the uterine

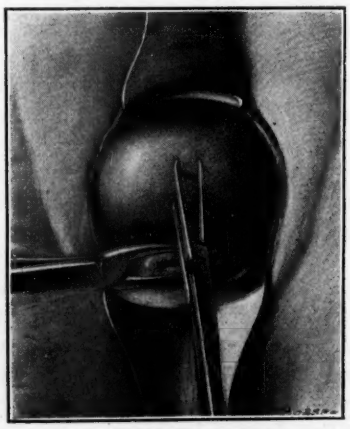

Figure 11.

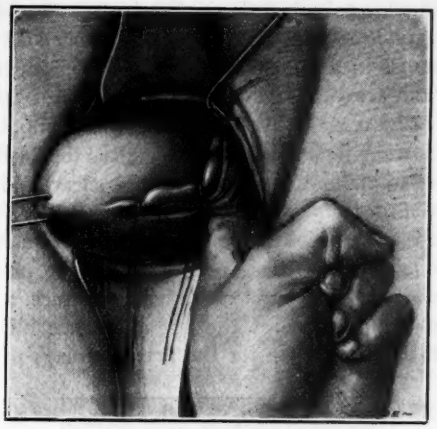

Figure 12.

artery may be recognized before it is cut if it lies deeply within the tissues which are being cut (Figure 7). Usually it lies close to the surface. In either event, if possible, it should be tied again before being cut through. This step is of value, for if by chance the uterine artery has not been caught by the second silk ligature applied as in Figure 6, it is essential that it be tied separately, and if as in the vast majority of instances the uterine artery is caught by the second ligature, the additonal tying of the artery doubly insures us against any possible subsequent bleeding. (Fig. 8.)

After this step has been carried out the peritoneal cavity is entered anteriorly by incision of the vesico-uterine pouch of peritoneum (Figure 9). An anterior speuculum is then introduced within the peritoneum and the anterior wall of the uterus is grasped

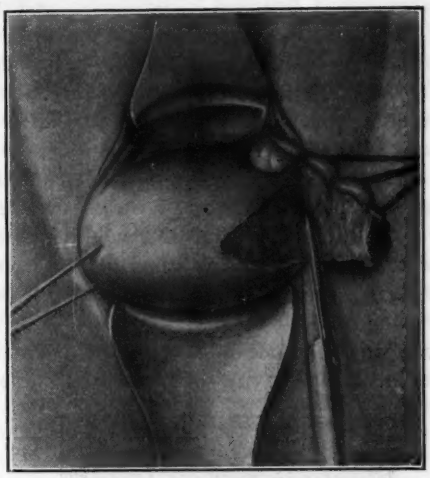

Figure 14.

by a pair of volsellum forceps (Figure 10). The cervix is now pushed back into the vagina, a wider speculum is introduced into the peritoneal cavity and the fundus is drawn out by successively applied volsellum forceps (Figure 11) until the fundus, tubes and ovaries lie outside of the vulva. Three silk ligatures are then applied on either side to solidly ligate the broad ligament. The first one is applied near the fundus and takes in about one-third of the width of the broad ligament; the second is applied external to this, taking in two-thirds of the width of the broad ligament, and the third external to this one takes in

Figure 13.

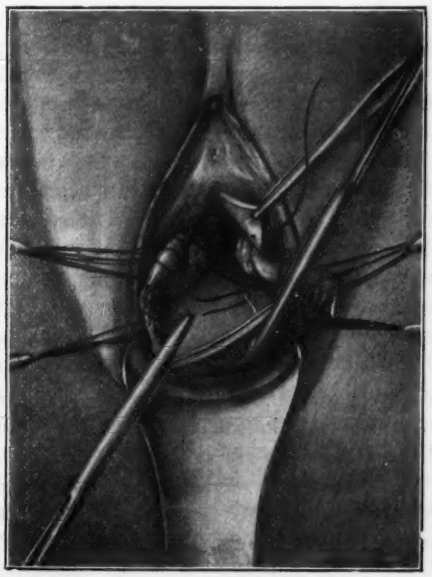

Figure 15.

the entire broad ligament (Figures 12 and 13). When his is done the uterus is cut off and removed, the scissors passing close to theu terine structure (Figure 14). Both uterine arteries have already been thoroughly tied and fastened to the lateral margins of the vaginal wall. The upper part of the broad ligament including the outer half of the tube, the ligament of the ovary and the ovarian arteries forms a thick, compact band held on either side by the three silk sutures. Any small bleeding points are now caught and tied and the operation is practically completed.

A long strip of iodoform gauze is now introduced into the peritoneal cavity to hold the intestine up

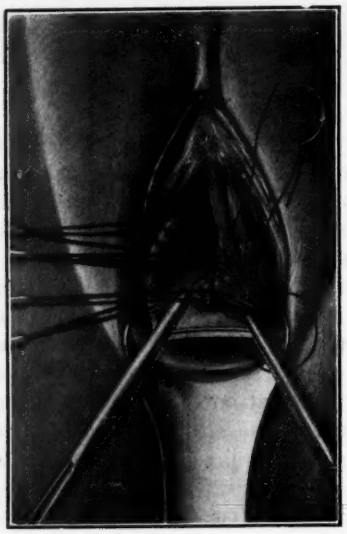

Figure 17.

out of the field of operation. A No. 3 chromic gut suture is now taken and passed as follows, with the aid of a heavy curved needle. It passes through the lateral margin of the longitudinal vaginal incision almost at its upper end, it then catches the ovary and broad ligament on its median side just near the attachment of the ligamentum ovarii, it then passes through the posterior vaginal wall and its attached peritoneum just median to the posterior clamp introduced at the beginning of the operation (Figure 15). It then passes through the lateral vaginal wall one-half inch above the silk ligature which caught the uterine artery. This suture is then drawn taut and tied firmly. As a result the entire thick upper portion of the broad ligament is attached closely to the lateral vaginal wall and is held outside of the peritoneal cavity (Figure 16). The same procedure is then carried out on the other side. The iodoform strip is drawn out and another wider, longer iodoform strip is introduced into the peritoneal cavity. Over the lower end of this strip which projects into the vagina, the five silk ligatures of either side are tied across in a double knot keeping this gauze in place and prevnting its slipping out into the vaginal canal (Figure 17). The vaginal canal is then packed with a wide strip of iodoform gauze, the bladder emptied to make sure that the urine is clear, and the operation is completed.

The operation when done in a leisurely manner rarely takes more than forty minutes, the patient suffers scarcely any post operative annoyance. Owing to the pressure of the vaginal gauze on the urethra it is advisable for the first few days to ca-

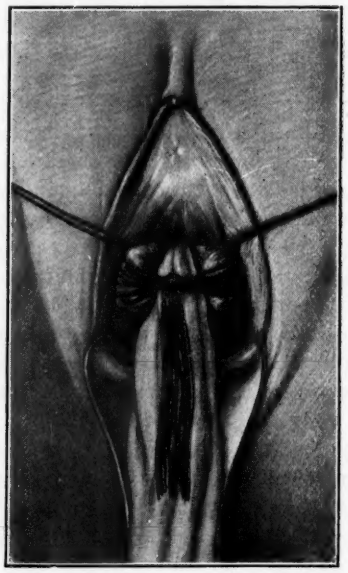

Figure 16.

thetize the patient. On the fifth day after the operation removal of the vaginal gauze is begun. The silk sutures which are tied over the intrauterine strip of gauze are no obstacle, and from this day on three to four inches of this wide intraperitoneal strips of iodoform gauze are drawn out each day. Finally, the vaginal fornix shows a cone-shaped denuded area containing the stumps of the broad ligaments. Daily vaginal douches are then given and in the course of a week or ten days complete healing and retraction has taken place. The value of packing iodoform gauze into the peritoneal cavity instead of closing up the edges of the vaginal incision is that because of the introduced gauze there is thrown out an exudation of lymph which eventually forms an artificial cul de sac of Douglas situated several inches higher than the normal one. It also prevents the intestine becoming by any chance adherent to the vaginal wound. These advantages diminish the

risk of the subsequent occurrence of a descent of the vagia, bladder, rectum, or the intestine. The purpose of sewing the lateral stumps of the broad ligament so firmly to the lateral borders of the vagina is that in the course of subsequent retraction of these stumps the lateral vaginal walls and bladder are pulled upwards and the occurrence of a cystocele or a descent of the intestine or a prolapse of the vaginal walls is reduced to a minimum.

134 WEST 87TH STREET.

DISLOCATIONS OF CERVICAL VERTEBRAE.

JAMES P. WARBASSE, M.D.

Chief Surgeon, German Hospital; Attending Surgeon, Seney M. E. Hospital,

BROOKLYN, NEW YORK.

Dislocations of vertebrae vary in degree. The most common are the slight subluxations which produce no pressure upon the cord, which give rise to more or less local discomfort, and which are important because the distortion is often great enough to cause pressure upon the spinal nerves passing out between the vertebrae. This pressure or irritation of the nerve trunks, in these more common cases, causes nerve disturbances which are referred remotely from the site of the lesion, namely, at the peripheral distribution of the nerves, and are manifested as peripheral pain, muscular weakness, or trophic derangements. These slight subluxations have been studied by Dr. Henry P. de Forest, of New York, to whom we are indebted more than to any other man for the descriptions of these conditions. He has shown by careful study of cases, by dissections of the spine, and by the treatment of a large number of persons with these subluxations, that they are quite common, and that they are responsible for many incorrect diagnoses. It is not my intention to deal in this paper with these subluxations.[1]

Beyond these slight subluxations of de Forest's is every degree of dislocation up to the extreme lesions causing pressure or even destruction of the cord. All of these injuries occur most commonly in the cervical segment of the spine, because of the greater mobility of the vertebrae in this region and because of the lesser degree of tendinous strength and the lesser extent of bony apposition. These dislocations occur with or without fracture of the articular processes. Not enough cases have had post-mortem examinations and not enough *x*-ray inspections and plates have been made to determine the relative frequency of fracture, dislocation, and fracture-dislocation. The best statistics available are those of Blassius.[2] But, in these statistics the results of *x*-ray examinations are wanting, and the diagnoses are necessarily speculative in many cases.

Most cervical dislocations are the result of extreme flexion of the head upon the thorax, the sternum often being broken by striking against the lower jaw. There must necessarily be rupture or separation of the intervertebral disk; and the ligaments are torn or separated, depending upon the character of the dislocation. In the anterior dislocations one or both articular processes may ride over the corresponding processes of the vertebra below and rest in the intervertebral notch. If this occurs on one side only, the body of the dislocated vertebra is advanced forward about one-fourth of its antero-posterior diameter. If both processes ride forward into the notches, the body is dislocated forward a distance equal to about one-half of its antero-posterior diameter. In the unilateral dislocation the cord is not compressed; in the bilateral dislocation there is pressure upon the cord.

Besides these most frequent forward dislocations, there are also unilateral and bilateral backward dislocations, and unilateral dislocations in opposite directions or by torsion. The dislocation is usually complicated by other injuries. If fracture is not present, there is rupture of ligaments. Hemorrhage from torn intervertebral veins or other vessels always takes place. Hemorrhage into the cord is not an uncommon complication. Paralysis due to hemorrhage must be differentiated from that due to bone pressure. More or less injury to the nerve trunks is present. Diagnosis can be made positively only by the help of the *x*-ray. Reduction should be attempted by traction upon the head. If the nature of the lesion is. In my own experiences, may be employed to cause the dislocated articular process to ride back into place.

The prognosis in dislocations between the atlas and axis is bad. Dislocations of the lower cervical vertebrae are more common, and the prognosis is less grave. The mortality is less in the unilateral than in the bilateral form.

We have encountered cases in which the lesion present seemed to be dislocation, but we can never know unless the vertebrae are exposed by operation or autopsy, or are shown by the *x*-ray, just what the nature of the lesion is. In my own experiences, the autopsy has shown dislocation when fracture

[1] Dr. de Forest has presented the results of his studies before a number of societies, but he has not yet published them.

[2] Blasius: "Die traumatische Wirlelverrenhungen," *Vierteljahrscrfift vür prak. Heilkunde*, 1869, Vol. CII, CIII.

was diagnosed and fracture when dislocation was diagnosed, and in a certain number of cases the nature of the bony lesion was not judged. Generally speaking, the dislocations are produced by muscular action or by extreme torsion, flexion or extension of the head. The fractures are produced usually by impactions of the trunk upon the cervical vertebrae and the skull. Figure 1 shows a bilateral forward dislocation of the sixth cervical vertebra.

The following case is of importance because the diagnosis was made by the *x*-ray, the dislocation still exists, and the patient is doing heavy work and enjoying good health.

L. U., German Hospital, 12,545. Male, age 30. The patient was brought into my service with the history of having f llen backwards into an areaway, while sitting upon a railing, a distance of about six feet, and striking upon the back of his head, the trunk being flexed upon the head. Upon admission there was pain and rigidity of the neck and tenderness over the whole cervical region. No displacement could be discovered by palpation either posteriorly or through the mouth. There was partial anesthesia of both hands, partial paralysis of all of the fingers and paralysis of the bladder. The reflexes were increased in both upper and lower extremities, particularly on the left side. A more careful examination of the nerve conditions by Dr. W. Browning showed the above conditions, and all the reflexes of the arm and forearm exaggerated. Sensation absent on back of hand. Knee-jerk active, ankle clonus active. All large muscles of the extremities tender. Babinski reflex present on both sides. It seemed to Dr. Browning that besides an injury to the cervical vertebrae there was also a fusiform hemorrhage in the gray matter of the cord extending well down into the cervical enlargement.

An *x*-ray picture showed anterior dislocation of the fifth cervical vertebra upon the sixth, the body being dislocated a distance equal to about one-fourth of its antero-posterior diameter. (Figure 2). This condition could not be discovered by palpation. Strong longitudinal extension was made, but the dislocation was not perceptably influenced. While extension was continued, a plaster splint was applied, encasing the head, neck and upper thorax and making pressure upon the chin and occiput and shoulders. There was a gradual improvement in the paralytic symptoms. Catheterization was not required after the seventeenth day. Sensation and motion in the hands returned. The plaster splint was removed at the end of five weeks and the patient allowed up and about on the sixth week.

X-ray plates made seven weeks after the injury showed the dislocation present. The patient left the hospital and went to work. At the end of four months there was practically no limitation in the motions of the neck. The head seemed pitched forward slightly more than normal. There was some tingling in the fingers of the right hand which was muscularly strong. The grip of the left hand was not so strong; and there was inability to extend completely the two last fingers. There was some feeling of stiffness of the quadriceps extensors. There was also a girdle sensation about the waist, present in the evening and absent in the morning.

Fig. 1. Bilateral Forward Dislocation of Sixth Cervical Vertebra. From Specimen in Guys Hospital Museum. International Text-Book of Surgery.

One year after the injury, January 27, 1909, examination shows the following conditions: The patient is strong and feels well, and does heavy work. The head and neck are freely movable. No pain. The two last fingers of the left hand cannot be extended completely nor tightly flexed. They are the seat of prickling sensations. Otherwise the hands are normal. The sphincter of the bladder is not strong. If the bladder is not emptied immediately, when there is a desire to urinate, dribbling takes place. The girdle sensation has disappeared, but in its place is the sensation of a lump or a drawing together sensation in the unbilical region. The patient feels well and looks well. There is some

pain in the region of the sixth cervical vertebra when the weather changes and becomes cold and damp. The patient, who was previously sexually vigorous, has been sexually impotent since the accident. An *x*-ray plate, made by Dr. Charles Eastmond, shows the dislocation practically unchanged. (Figure 3).

I have been much interested in studying the *x*-ray plates of this case, and comparing them with disarticulated cervical vertebrae. As a result of these comparisons, it is evident that the dislocation is unilateral, for in the bilateral dislocation the body must be moved forward a distance equal to about one-half of its antero-posterior diameter, as is shown in Figure 1. This is absolutely pathognomonic, if the lesion is a dislocation and not a fracture. If the dislocation is unilateral, then the degree of displacement is as is shown in Figure 2 and Figure 3. These two figures show the two sides of the neck. Figure 2 shows the dislocated articular process, that of the fifth lying in front of that of the sixth. Figure 3 shows the articular processes lying in normal relation, that of the fifth behind that of the sixth. Figure 2 is taken with the patient's left side nearest the plate; Figure 3, with the right side. An antero-posterior picture shows the spine of the fifth vertebra deviated to the left. Thus it is evident that the left articular process of the fifth vertebra has ridden over in front of the process of the sixth, and rests in the left intervertebral notch.

The only persistent and unchanging symptom has been the inability to completely extend the last two fingers of the left hand. This I believe to be due to injury to the sixth cervical nerve caused by the articular process of the fifth vertebra falling into the intervertebral notch occupied by this nerve. It will be recalled that these two fingers are extended by the extensor communis digitorum and the extensor minimi digiti muscles, which are supplied by the posterior cord of the musculo-spiral nerve, which is composed of cords from the sixth and seventh cervical.

It has been possible in cases of unilateral dislocation of cervical vertebrae, to unlock the processes by strong lateral flexion towards the opposite side, combined with traction and appropriate pressure. In such a case, associated with hemorrhage into the cord which is already producing symptoms in the lower extremities and visceral paralysis, I should advise against manipulation of the neck further than longitudinal extension, if the symptoms of bony pressure are but slight and involve only the upper extremities. But if there is no evidence of hemorrhage every effort should be made to reduce the dislocation.

Fig. 2. Unilateral Forward Dislocation of Fifth Cervical Vertebra. Observe left articular process dislocated forward into intervertebral notch. The superior articular process of the sixth vertebra is seen *posterior* to the articular process of the fifth at A. The arrow indicates the dislocation of the body.

Fig. 3. Unilateral Forward Dislocation of Fifth Cervical Vertebra One Year After Injury. The superior articular process of the sixth vertebra of the right side is seen *anterior* to the articular process of the fifth in normal relation at B. The arrow indicates the dislocation of the body.

385 WASHINGTON AVENUE.

PERITONITIS DUE TO APPENDICITIS.

It is true the exudation of serum and leucocytes on the part of the peritoneum is, as everywhere in the body, a salutary process which has for its object the warfare against the inroads of the bacteria. But, on the other hand, an extension of the purulent serum implies also the spreading of the poisonous material, and experience shows that in diffuse suppurative peritonitis the struggle, as a rule, terminates in favor of the bacteria, as the disease almost invariably ends fatally without surgical treatment.—FRANZ TOREK in *The New York Medical Journal.*

A PLASTIC MASTOID OPERATION; A NEW OPERATION FOR ACUTE MASTOIDITIS.*

FRANK TUCKER HOPKINS, M.D.,

Assistant Surgeon, Aural, New York Eye and Ear Infirmary.

Although the technic of the mastoid operation for acute mastoiditis is generally well understood and satisfactorily carried out, we have as yet accomplished little in shortening the length of time required for the after-treatment, which remains still a labor of many weeks' duration. In recent years, however, two methods have been proposed with this end in view.

1. The Blood Clot Method, and,
2. The so-called Modified Blood Clot Method.[1]

In the blood clot method the posterior wound (the skin incision) is closed absolutely, and the bone cavity is supposed to fill up with a blood clot which is later to become organized. In the modified method there is no blood clot at all. The wound is sutured throughout with the exception of a small opening at its most dependent portion, through which the drainage of the cavity is secured. The granulations are left to take care of themselves, and the drain is removed when the granulations have sufficiently filled the cavity to make the introduction of the drain difficult.

While in some cases both of these methods have given brilliant results, yet in other cases very serious accidents have followed, due to the loose piling up of granulations and the burrowing of pus through easily formed fistulous tracts. The surgeon has no control of the granulating process, and no knowledge of the burrowing of pus, until some abscess, more or less deeply placed, produces unfortunate results.

In this connection we may mention Plummer's[2] method, which, with the modified blood clot as a basis, endeavors to fill up the greater part of the bony cavity by bodily pushing back the posterior wall of the membranous canal (having lowered the bony wall to do this) and holding this membranous wall in approximation to the bony surface by firmly packing the canal. The posterior wound is then partially sutured and drained. Here the same objection obtains as in the former method,—that of an uncontrolled granulating process in a closed cavity.

In 1877, Wolf[3] suggested making an opening for drainage through the posterior canal wall, after removing the bony wall to do this, and then closing the initial incision throughout except at its lower angle, which was to be left open, thus affording opportunity for thorough irrigation of the bone cavity. I do not know whether the later methods were based on Wolf's suggestion or not, but his method did not, at that time, meet with much favor; and for acute mastoiditis no essential change in after-treatment was made until the blood clot mentioned was proposed.

The method I am about to describe, and which I have called a plastic mastoid operation, consists, in a word, of first, making a meatal opening through the concha and posterior canal wall; secondly, the complete closure of the posterior, or initial incision; and, finally, the cicatrization of the excavated mastoid surface; in other words, the application to *acute* cases of the plastic methods now used only in radical operations.

In the details of the operation my method follows along the lines of the Heath operation for *chronic* purulent otitis media, which Heath proposed in 1906, and which with more elaborate technic was described by Ballenger in 1908, but which has not been used by either of these surgeons for cases of *acute* mastoiditis. My method is simple and free from danger, and the time required for post-operative treatment is much shorter than by the present method of filling the bone cavity with granulations.

In the method I suppose, the usual mastoid operation is done, and with the same care and attention to detail. When in all other respects the mastoid operation is complete, the outer portion of the posterior bony wall of the canal is cut away about to the level of the floor of the canal so that it shall offer no hindrance to free drainage. This removal extends as far inward as the outer wall of the antrum, but the outer wall of the antrum, unless necrotic, should be left intact. An opening is then made in the concha and posterior fibro-cartilaginous wall of the meatus, exactly as is done in the radical operation; but in doing this the precaution must be observed that no traction be made on the membranous canal which shall disturb the position of the membrana tympani. The style of the incision—the shape of the meatal flap—is unimportant; either a Ballance incision, curved and tongue-shaped, or a Panse incision, T-shaped, and giving two quadrilateral flaps, may be chosen; the object being to furnish a window of sufficient size to give drainage and make the excavated mastoid surface accessible, through the meatus. The carti-

* Read before the Section on Otology of the N. Y. Academy of Medicine, January 8, 1909.

lage included in the flaps must be dissected out, the flaps turned back to line the mastoid cavity,—the raw surface against the raw posterior surface of this canal wall,—and should be secured in this position by catgut sutures. These sutures must be passed through the periosteum or through an aponeurosis of muscle, but not through muscle tissue, else they will be apt to pull out and permit the flap to sag, which will eventually leave the opening inconveniently small. When the flaps have been secured the cavity is packed with a strip of iodoform gauze, and the end of the gauze brought out through the meatus. The posterior wound is sutured throughout with silkworm-gut, and the usual dressings applied. At the end of five days the dressings are removed, the stitches of the initial incision are taken out, and this wound should be found healed throughout by first intention. The packing is carefully removed through the meatal opening, and the cavity, after cleansing by irrigation and by swabbing, is again somewhat lightly packed. For a day or two longer a light protective dressing may be applied behind the ear.

In considering this mastoid excavation and the healing of it, we must disabuse our minds of any idea of a cavity to be filled up with granulations. Such is not the case. Rather, it is a surface which, having granulated, is to be covered with cicatricial tissue, and so must be treated as the similar surface of the radical operation,—though it may be a little more extensive in its area, since it dips downward into the region previously occupied by the mastoid tip.

The subsequent treatment consists of applications through the meatus, which should be made daily. If granulations are exuberant, the curette or silver bead is applied. When cicatrization has begun there should be no packing, and usually swabbing is better than syringing. Most important is the careful attention to exuberant granulations, especially in the posterior-inferior angle where they often escape notice and become very troublesome. Cicatrization will soon be found spreading up over the antrum and along the vault of the cavity. The whole surface may be expected to be dry in five or six weeks.

To lessen even this short period of the time required for healing we may have recourse to skin grafting. At the end of two weeks a firm and satisfactory granulating surface will give opportunity for a graft to take. This may be applied through the meatus, and, if successful, it will materially shorten the time of cicatrization; or the posterior wound may be reopened, a Thiersch graft inserted, and the wound sutured again, as in secondary grafting in radical cases.

In case the skin is inflamed at the time of the primary operation, the suturing may be postponed a few days, in the meantime packing the wound. The same method holds good if it has been necessary to open the sinus.

The advantages which I claim for this method are its simplicity, its ease of handling, its better appearance, its rapid healing with perfect safety, and the better hearing which results.

Although the operation itself is more troublesome and requires a little longer time than the usual operation, the after-treatment is easier and more quickly conducted each day, and less painful to the patient.

Again, it avoids the disfigurement of a wide scar behind the ear, or the equally unpleasant post-aural depression, occasionally seen.

My method gives more rapid healing. It is rare that an ordinary mastoid wound is fully healed under eight weeks, while here we may obtain healing in from five to six weeks. And aside from the great advantage of the more rapid healing of the whole wound, is the great importance of the prompt healing of the *post-aural incision,* for with this method *the bandage may be entirely discarded in ten days.* In general, also, by this method the hearing is better than by our present method of operation because the canal is not narrowed, as is now often the case, by a partial prolapse of the posterior wall, but on the contrary, it is widened, leaving a free canal.

As I have thus far done this operation in only five cases, my paper is offered as a preliminary report on a new operative procedure; but since these cases include very severe mastoid conditions, in which my results have been exceedingly satisfactory, I have felt justified in offering for consideration this description of the operation, and a brief résumé of my cases.

CASE I. H. W. The first case on which I performed this operation was that of a simple mastoiditis with mixed infection, in a man twenty-four years of age. There was in this case an exostosis of the posterior canal wall which made it necessary to open the membranous canal. The dressing of this case was difficult on account of a congenital subluxation of the inferior maxilla, which distorted the canal. The ear was dry in nine weeks, however, while the posterior wound was completely healed under the first dressing.

CASE II. M. H., a man thirty-one years of age. The discharge had been present three weeks. The smear showed a streptococcus capsulatus infection. In operating it was necessary to expose the sinus

over a large area. Under the first dressing the posterior wound healed throughout, with the exception of half an inch at the lower angle, which healed under the second dressing. The rest of the wound was dry in eight weeks.

CASE III. N. L., a woman thirty-five years of age with a four days' history of discharge, which showed a streptococcus infection. The operation exposed the sinus over a large area including the knee. The zygomatic cells were also involved. The posterior wound healed under the first dressing. The wound was dry in a little less than eight weeks.

CASE IV. P. D., a woman, forty-seven years of age. The discharge had been present nineteen days and showed a pneumococcus infection. The case was a very severe one. On admission there was a large subperiosteal abscess. The canal was so much narrowed by swelling that the membrana tympani could not be seen. The mastoid destruction was very extensive and involved also the zygomatic cells. There was also a large epidural abscess in the middle fossa, and a perisinus abscess; and both of these exposures were covered with thick velvety granulations. Here, on account of the superficial inflammation caused by the subperiosteal abscess, the incision behind the ear did not heal by first intention through its lower half, but was closed by a second suturing at the end of a week, and healed promptly. In this case at the end of two weeks, I inserted a small skin graft through the meatal opening. Part of this graft took, and helped to make the cicatrization more rapid. The cavity healed in five weeks and two days.

CASE V. The last case is still under treatment and so I cannot give any definite report on it at this time.

All my cases have been operated upon at the New York Eye and Ear Infirmary, and all were ward cases.

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[1] REIK, *Journal of the American Medical Association*, March 31, 1906.
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[2] PLUMMER, *Journal of the American Medical Association*, November 24, 1906.
[3] WOLF, *Berliner Klinische Wochenschrift*, 1877, p. 205.
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DEEP TENDERNESS IN HERNIA.

Extreme sensitiveness, either in the tumor or surrounding parts, during the manipulation of a hernia, should always cause the surgeon to suspect that there is some condition present other than hernia. Uncomplicated hernia is rarely extremely sensitive, and while the wearing of a strong truss may produce painful surface irritation, it should not cause deep-seated pain unless there is some other pathologic condition.—W. B. DE GARMO in *The Post-Graduate.*

A MODIFIED OPERATION FOR INGUINAL HERNIA.*

ALBERT E. SELLENINGS, M.D.,
NEW YORK CITY.

An apology is perhaps expected from any one who would venture to suggest a new operation for the repair of inguinal hernia when the many already at our command seem to meet all the essential requirements. But the offense is perhaps mitigated when it is proposed to deviate from the usual procedures only in one particular step, with the single object in view of simplifying the operation as a whole. Any suggestion in technic which obviates undue manipulation of tissues has much to commend it and should be accepted, provided the basic principles of the operation are complied with and adhered to. The success of any operation for hernia depends, in no small measure, among other things, upon the least possible trauma to tissues and structures, which result is not always incident to the usual methods of ablation of the sac. The prevailing technic of isolation of the sac and the transplantation of the cord has no good anatomical, physiological, surgical, or mechanical advantage, and should therefore be characterized as an unnecessary refinement. Upon this basis the proposition advocated in this paper is suggested and advanced as entirely compatible with safety and efficiency, combining, as it does, all the essential requirements and principles.

The feature of the operation now under discussion lies in the treatment of the hernial sac which is permitted to remain in its bed practically undisturbed. In other details, it follows the procedures usually employed and generally accepted.

The principles which underlie the rationale of the operation and form the basis of the technic may now be briefly considered. In the normal descent of the testicle, a diverticulum of peritoneum, the processus vaginalis, precedes it clothed with its mesorchium, to its final resting place in the scrotum. At a certain stage, therefore, there is a communication between the processus vaginalis and the abdominal peritoneum. Later this communication is lost by an obliteration of the upper part of the diverticulum, so that the testicle lies in its scrotal bed covered by a serous layer derived from the abdominal peritoneum, but having no connection with it. A similar process of obliteration and blending of the peritoneum is observed in the peri-

* Read before the Alumni Society of Bellevue Hospital, January 6, 1909.

toneal development of the pancreas. When first developed this viscus possesses a complete peritoneal covering, lying between the two layers of the posterior mesogastrium. At this stage, then, the stomach has changed its position by rotation, carrying the pancreas with it, the now posterior covering of the head of the pancreas lies in contact with the serous covering of the right kidney and soon becomes obliterated by absorption. In like manner the stomach by its further adaptation to the cavity of the abdomen carries the tail of the pancreas to the left, causing its posterior layer of peritoneum to lie in contact with the left kidney and its peritoneal covering. The same process of

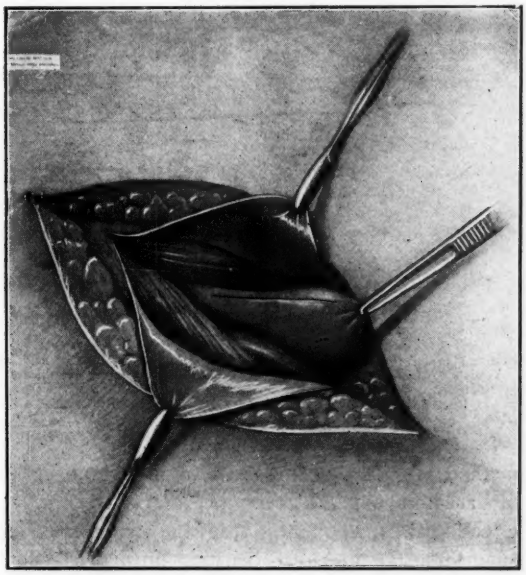

Figure 1.—Skin of Superficial Fascia and External Oblique Have Been Incised, Showing Bulging Hernial Sac. Incision Through Sac is Indicated.

obliteration takes place and the pancreas now lies wholly in the retro-peritoneal space. A further review of other viscera as regards the development of their peritoneal relations need not at this time be considered, since the formative processes exhibited by the pancreas serve sufficiently to illustrate the fact that contiguous layers of peritoneum brought into contact adhere, blend and obliterate. That the adult peritoneum is capable of such blending and obliteration is well illustrated in intestinal anastomosis in plication of the gastro-hepatic omentum and stomach, and in all conditions where peritoneal suture is employed. Whatever be the methods of securing peritoneal apposition, or whatever be the conditions for its employment, the histological findings reveal that the resulting union is continuous and that the peritoneum as such has lost its identity. Matas in his article on the "Radical Cure of Aneurism" (*Annals of Surgery,* February, 1903) regards the aneurismal sac as a large diverticulum or prolongation of the parent artery with which it is connected. Quoting further from his paper, he observes that "the lining membrane of the sac is a continuation or expansion of the endothelial intima which lines the interior of the artery, and in fact of the entire vascular system, and that the sac itself, when not disturbed from its vascular connections, is capable of exhibiting all the reparative and regenerative reactions which characterize the endothelial surfaces in general when subjected to irritation." The analogy between the aneurismal sac and the hernial sac is apparent. And it is also

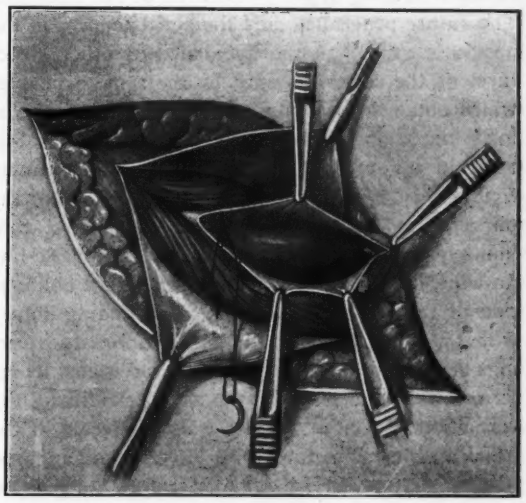

Figure 2.—The Purse String Suture Has Been Placed Well Within the Lumen of the Sac. Traction on the Sac Will Insure the Placing of the Suture Sufficiently High to Avoid Any Pouching at the Site of the Internal Ring.

clearly evident that the hernial sac is a prolongation of the abdominal peritoneum and as such will exhibit all the tendencies to occlusion and obliteration, when carefully approximated by suture. And, further, it may be added that whatever be the gross change in the hernial sac, its peculiar identity remains, and its interior when subjected to pressure and irritation is still capable of a reaction as described above.

These brief preliminary remarks serve to introduce the details of the operation, which are as follows:

The skin and superficial fascia are incised, exposing the bulging sac and its intimate coverings. The sac is further exposed by incising the external oblique aponeurosis, in a direction parallel to its fibres. The sac is now revealed (Figure 1) and in

accordance with the proposed modification, its relations to other structures of the canal are left undisturbed and no dissection whatever is attempted. An incision is made in the longitudinal axis of the sac (Figure 1) its contents thus being exposed, are inspected and returned to the abdominal cavity. The interior of the sac is now rubbed with a gauze sponge or scarified with the point of a needle, so as to more readily favor the cohesion of its subsequently opposed peritoneal surfaces. The next step is the closure of the sac at the internal ring. With a well curved needle carrying plain catgut No. 2, a purse string suture is placed well within the lumen of the sac, as illustrated in Figure 2. A little traction on the sac will insure the placing of the suture sufficiently high and will thus avoid any outward bulging of the peritoneum at this situation. The suture penetrates only the peritoneum, and the needle is guided in the avoidance of other structures of the canal and cord by the same principles which obtain in peritoneal technic in general. The inclusion of any part of the cord, therefore, in this or in the following step of the operation is a remote contingency. The portion of the sac distal to the purse string suture is now obliterated by a continuous suture as depicted in the diagrammatic line drawing (Figure 3). The final step in the obliteration of the sac is the placing of a running suture which approximates the sac and its intimate coverings at the site of the incision which revealed its interior. After disposal of the sac as described, the formation of a new anterior wall is effected in the usual manner, by suture, with interrupted kangaroo tendon, of the internal oblique and conjoined tendon to the sharp shelving border of Poupart's ligament. The cord and its structures, however, are permitted to repose beneath this new anterior wall, and necessarily so, since there has been no dissection of these structures. This burying of the cord is similar to the method advanced by Ferguson and now generally adopted as an advance over the former procedure of transplantation as in the Bassini operation. In the final steps the aponeurosis of the external oblique is sutured with plain catgut No. 2, and the skin with fine gut or silk. A résumé of the foregoing shows but a single deviation (suture obliteration of the sac) from the steps of the usual operations, which in their sac dissection necessarily inflict varying degrees of trauma on the sac itself, the cord and testicle, and make uncertain the integrity of the nerve supply. In the author's modification it is to be noted that the cord or testicle are, at no time during the operation, disturbed or manipulated.

The essential principles underlying the operation for inguinal hernia may be embodied under two heads; closure of the sac at the internal ring, and the formation of a new anterior wall for the inguinal canal. In other words, the aim of the operation is to restore the rotundity of the peritoneum and to construct a barrier which shall act as a restraining wall against the protrusion of any viscus through the internal ring. All operations have these points in common and they differ only in the way in which they are effected. A consideration of the second of these aims is foreign to our present discussion and deserves no criticism. A choice of operation then depends upon which

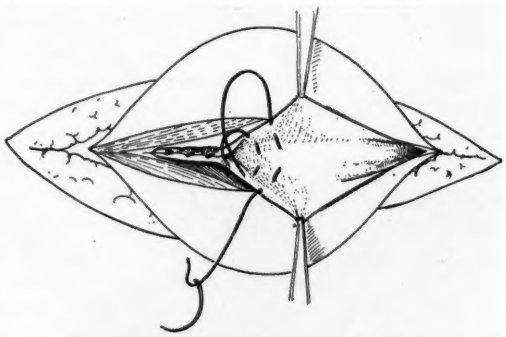

Figure 3.—Schematic Line Drawing Showing Obliteration of the Sac With Continuous Suture. In the Illustration the Sac Has Been Much Elongated in Order to Show the Method of Suture Better. Five to Eight Sutures Will Ordinarily Suffice to Effect Closure.

method appeals as being least involved and easiest of accomplishment. The prevailing technic of effecting the first of these steps the writer considers superfluous at the cost of inviting unfavorable complications, both immediate and remote. And even in the absence of complications, this detail we consider without manifest advantage. That the same closure at the internal ring may be attained by a simpler technic consuming less time is very apparent in view of our previous observation, that when endothelial surfaces have been approximated and have been subjected to irritation and constant pressure, the inevitable result is one of obliteration, based on the embryological and histological data considered in our introductory remarks.

Even though the author's claim of a time-saving factor should not enter in the consideration of this modification, the advantage would still be in favor of suture obliteration, if for no other reason than that which is inherent in a non manipulation of the cord and other structures at the canal. Moreover, I am certain that suture obliteration may be accomplished in considerably less time than is required

for isolation and resection. This fact has been repeatedly shown but it is scarcely justifiable to suggest this element as the prime argument in favor of this newer procedure. In the smaller herniae the modification cannot serve to an advantage as far as the time element is concerned, since isolation in these cases has always been a most easy and rapidly performed step. In the smaller herniae, then, we may discuss a consideration of the rapidity and emphasize the other advantages. In the larger herniae with thick and densely adherent walls, however, rapidity does not enter as a striking factor, and it is in these cases that all the advantages claimed for the modification obtain in full significance.

The possible criticism which is likely to arise in

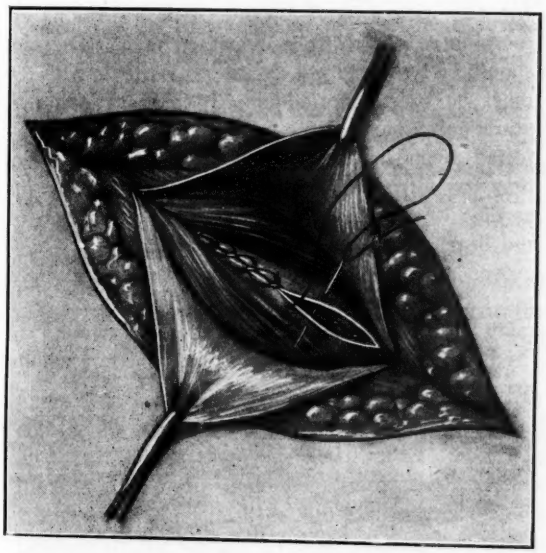

Figure 4.—Shows the Continuous Suture in the Final Step of Complete Obliteration. Figure 5 Shows the Same Suture but in a More Diagramatic Way. The Sac is Seen to Blend With Its Adjacent Structures and Its Margins Therefore Have Not Been Outlined as in the Following Schematic Illustration.

connection with suture obliteration of the sac has not been left unconsidered in my clinical observations. A natural doubt arose in my earlier cases as to the behavior of the remnant of the sac so left. It is sufficient to say that no pathological condition of the distal portion of the hernial sac has been observed, or has occurred, which fact is in harmony with the principles already set forth. The formation of a cyst or hydrocele is most remote and quite impossible if the inner surfaces of the sac have been accurately and carefully approximated. Aside from the pressure and irritation applied from within the sac we must concede the presence of a positive pressure effected by the overlying structures, as a significant factor in the process of effacement. In the McEwen operation, the sac, though isolated, is not cut away, but is applied as a pad at the site of the internal ring. Even though deprived of its vascular supply, autopsy report shows this pad of peritoneum completely absorbed. (*Von Bergman's System of Surgery.*)

In conclusion we would submit that the dissection of the sac has no anatomical or surgical advantage, and should therefore not be insisted upon as an essential requirement in the details of the operation. If the continuity of the peritoneum at the site of the internal ring has been restored, and the portion of the sac distal to this, obliterated, the first

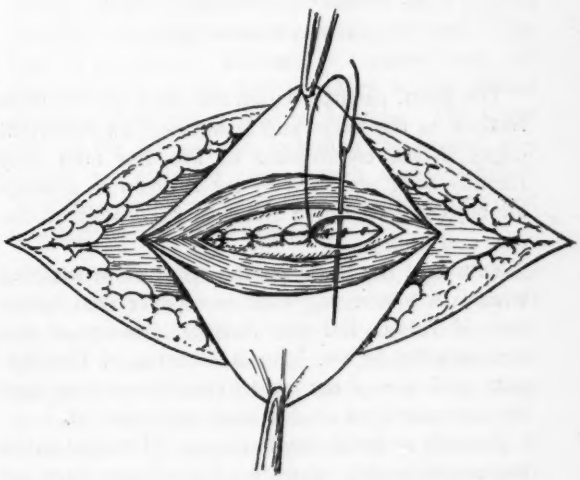

Figure 5.—Schematic Drawing Showing Final Suture as in Figure 4 But More Diagramatic. This Suture, as will be Noted, Approximates That Portion of the Sac Which Has Not Been Included and Opposed by the First Suture. This Suture May be Omitted if the First Has Been Introduced Sufficiently Near the Edge of the Sac Wall to Insure an Apposition of Its Entire Endothelial Surface.

principle in the radical cure of hernia has been attained.

It is only fair to say that the uniformly good results which have attended the cases up to the present have been an encouragement to further trial, with the firm conviction that subsequent experience will fully justify our present attitude. An experience with some twenty odd cases without a single untoward circumstance, I believe, warrants this preliminary presentation.

The advantages of this simplified technic may be summarized under the following heads:

1. Rapidity of performance.
2. Diminished period of narcosis.
3. No dissection of sac, and tissue bruising therefore eliminated.

4. Preservation of nerve distribution.

5. Absence of the sometime troublesome venous hemorrhage.

6. No manipulation of the cord, its vessels or the testicle.

We may further epitomize the above headings in the one word *simplicity*, which in the broadest sense, combined with efficiency, implies ideal surgical technic.

104 EAST 31ST STREET.

SURGERY OF THE PERICARDIUM AND HEART.*

H. BEECKMAN DELATOUR, M.D.

BROOKLYN, NEW YORK.

The heart, situated within the chest in such close relation to the lungs and being such an important organ in the continuance of life, has until very recently been neglected by the surgeon as a possible object of operative attack in conditions of disease and injury.

Suture of the heart for the relief of penetrating wounds was first suggested in a paper read before the old Anatomical and Surgical Society of this city, in 1881, by Dr. John B. Roberts, of Philadelphia, and it was not until fifteen years later that the first operation of this kind was reported.

As early as the sixteenth century Hollcrius made the assertion that wounds of the heart were not necessarily fatal, and since then it has been shown a number of times that persons receiving heart injuries while in combat have followed up their adversaries for some little time before succumbing.

It was Morgagni who first recognized that compression of the heart by the accumulation of blood in the pericardium was the cause of death in many cases.

Fisher in 1867 from a study of 452 cardiac wounds established the fact that an individual might exist for hours or even days with a wounded heart and that in from 7 to 10 per cent. of the cases the wound heals and the patient actually recovers. Kiawoff gives practically the same figures.

Billroth as late as 1883 declared that no surgeon who wished to preserve the respect of his colleagues would even attempt to suture a wound of the heart.

Tillman's text-book of surgery (1897) gives the following treatment of injuries of the heart:

"The treatment of injuries of the pericardium and the heart is, generally speaking, symptomatic; but since the adoption of antiseptic methods in surgery, a more active treatment is properly made use of. Here also probing should be avoided as far as possible. If the internal mammary or the intercostal arteries are injured, hemorrhage from these is arrested by ligation. We are powerless against severe hemorrhage from the heart. Unfortunately, cardiac wounds cannot be closed by suture. Any foreign bodies that may be present are, if possible, removed. The external wound, and, if necessary, that of the pericardium also, is disinfected according to general rules, drained if necessary, and covered with an antiseptic protective dressing. This is changed upon the appearance of fever, dyspena or pain. Absolute quiet is of the greatest importance for the patient, and hypodermatic injections of morphin can scarcely be dispensed with. The diet should be light and not exciting. Wine or whiskey must be strictly forbidden. In case of collapse, stimulants, particularly camphor and ether, injected hypodermatically, are indicated. Venesection was formerly recommended very generally for cardiac wounds in order to diminish the action of the heart and to restrict the hemorrhage. Reidinger also is of the opinion that blood-letting ought not to be abandoned entirely in these cases. As a matter of fact, hemorrhage from the wound in the heart has been very much diminished or wholly arrested by venesection.

When blood has collected in the pericardium (hemopericardium), causing cyanosis or cardiac weakness, puncture or incision of the pericardium is to be recommended, likewise when there is marked serous or suppurative effusion in the same. In these cases a trial puncture with an aspirating needle should first be made, and if this reveals the presence of pus the incision is to be made in the middle of the area of heart dulness, usually in the fourth intercostal space. After the incision of the pericardium in case of suppurative pericarditis, the same should be drained. If the trial puncture reveals blood or serum—that is, hemopericardium or serous effusion—the contents of the pericardium should be evacuated by puncture. This has been especially recommended by Rose in case of hemopericardium with compression of the heart. But in very large effusions of blood, incision might often prove more effective than puncture."

In contrast with these statements is that of Hill, of Montgomery. In the most recent paper published on this subject, Hill says "The surgeon not only would be justified but it is his bounden duty to

* Read before the Kings County Medical Society, October 20, 1908.

operate upon every one of these cases, for it is more important, if possible, to rescue a drowning heart than to relieve a strangulated hernia."

In 1894 Kronecker pointed out the fact that the heart could be punctured with but little interference with its action, except when a spot (Kronecker's co-ordination center) in the interventricular septum was touched, when immediate death ensued. The interesting conclusions drawn by Elsberg[1] from experimental investigations are as follows:

"That the heart could be grasped with the hands or forceps and gently compressed, with no appreciable difference in its action, and that it could be penetrated by a needle and knife, producing only a temporary irregularity of its action; that penetrating wounds produced during systole bled more than those produced during diastole, and that wounds of the ventricles produced during systole were larger than those produced during diastole; that oblique wounds bled less than perpendicular wounds; that wounds of the right ventricle were more dangerous than those of the left because the wall of the right ventricle was thinner, and also because the blood in the right side of the heart coagulated more slowly; that wounds of the heart heal kindly and that the cicatrix is usually complete in about fourteen days; that interrupted sutures are better than continuous ones; that the tissue included in the suture always atrophied, and was replaced by scar; a smaller number of muscular fibers was included in the interrupted than in the continuous suture, thus producing less atrophy and less scar tissue; that superficial sutures were less likely to tear out than deep ones, and that the sutures should be inserted and tied during diastole because of the danger of their tearing out if tied during systole."

The first successful cardiorrhaphy was published by Rehn in 1897. In 1907, Rehn[2] collected 124 cases of suture of the heart for wounds with 49 recoveries (40 per cent). Of this number 9 were performed in the United States, with 5 recoveries. It is probable that this table does not include all cases operated, as many unsuccessful cases are likely not reported.

Dr. Francis T. Stewart[1] of Philadelphia, in May, 1904, in connection with a case of his own presented a table showing a record of sixty cases operated for stab wounds. Of this number twenty-three recovered and thirty-seven died. Of the deaths, sixteen occurred within twenty-four hours from shock and hemorrhage, three died on the second day, four on the third day, two on the fourth day, three on the fifth day, and one each on the sixth, fourteenth, nineteenth and twenty-second days; in five the time of death is not stated. Of the cases dying after the second day, nearly all were due to sepsis. In most of the cases the pleura was also injured and became infected. Even in the cases of recovery many were complicated by an empyema. As it is fair to presume that the object making the wound is rendered sterile by passing through the more superficial tissues before reaching the heart, the probable cause of so large a proportion of infected cases is to be found in the necessarily hurried preparation of the field of operation.

Meerwein[3] states that in the one hundred and twenty cases of operative treatment of heart injuries recorded, mention is made of only one case of injury of an auricle. He reports a second case, and states that it is the first in which a stab wound of the auricle was treated by ligation. The lower part of the left auricle, including the wound, was drawn out and tied around with a stout thread. This was done sixteen hours after the injury, and was followed by rapid recovery.

Sauerbruch[4] operating with his air cabinet relates his experiences in experimental surgery of the heart and states that temporary occlusion of the afferent veins is practicable, and much reduces the danger and difficulty of the work, especially when suturing the right heart after a stab wound.

Haecker[4] by experiments on dogs showed it to be possible to operate on the almost empty heart by compressing the afferent vessels, and that extensive incisions could be made in the different cavities of the heart without permanent injury to the organ. This fact, he thinks, opens fine prospects for surgical intervention on the heart, especially for foreign bodies. His work was done mostly in the Sauerbruch air cabinet, which allowed the chest to be opened up without fear of pneumothorax, the lung continuing its functions undisturbed, while reducing the tendency to hemorrhage when the incison was made, and the danger of infecting the pleural cavity. In suturing the organ it should be held in such a way that the fingers can compress the afferent veins. By displacing the heart forward the vessels are kinked and this arrests the blood supply. He recommends a button suture with medium-sized catgut or silk, taking in only the myocardium and epicardium. The ends of the thread in the first suture are left long and help to hold the organ. The superior and inferior vena cava could be clamped for ten minutes, in the experiments on

dogs, without serious results to the animal. By clamping these veins and the left coronary vein, brief operations could be done with the heart empty without serious consequences. This allows the different cavities of the heart to be opened up and thoroughly searched for a foreign body. and even large parts resected. No air embolism was noted, probably from the under pressure prevailing in the cabinet. Small foreign bodies were constantly swept along with the blood current, but needles lodged in the cavities of the heart. His experience seems to indicate that there is a certain point in the walls of the heart near the mitral orifice, injury of which is followed by immediate arrest of the heart action.

The statistics of Rehn giving all cases up to the middle of 1907, give one hundred and twenty-four cases with 40 per cent. recoveries. In seven hundred and twenty-nine cases collected by Fischer in which no operation was done, less than 16 per cent. of the patients survived.

Franke[6] after reviewing the published reports says, "they all tend to prove that the great danger in case of injury of the heart is from pressure on the organ from the blood accumulating in the pericardium. This pressure is the main source of the disturbances in the functioning of the heart—not the injury itself. No matter whether an operation is contemplated or not, the first step is to remove this pressure by puncture and aspiration of the accumulated blood. In most cases, this will render further operative intervention unnecessary, and in all cases should precede it. He urges the general practitioner to puncture when symptoms develop—not waiting for surgical assistance. Even at the best, he adds, more extensive operative treatment is apt to be accompanied by complications leaving a predisposition to organic affections later.

Symptoms.—The symptoms are somewhat dependent on the nature of the wound. If there is external loss of blood or bleeding into the pleura the symptoms will be of an acute anemia. If the bleeding is entirely within the pericardium, the anemia will not be so marked, but the embarrassment of heart, due to compression, will be the marked symptom. When the bleeding is external it may be either continuous or in jets.

The location of the external wound is a factor to be considered. The pulse is weak and irregular and if blood is confined to the pericardium the apex beat may be neither felt nor heard. Frequent attacks of syncope are common—and usually marked dyspnea, due to the loss of blood, and compression of the lung through injury to the pleura (the pleura being injured in 57 of the 60 cases recorded by Stewart). When time permits and diagnosis is uncertain the X-ray will show the presence of blood confined in the pericardium.

The size of the wound in the heart cannot be judged by the size of the superficial wound; in fact a number of cases are recorded where, in stab wounds, the heart injury was much more extensive, apparently being due to the movement of the organ while the blade of the knife was entering it.

There is likely to be both hemo- and pneumothorax as the result of injury to the pleura and lung.

Prognosis—Bochardt[7] divides the cases as follows:

First.—Those dying immediately, including those cases from severe violence resulting in extensive laceration or rupture of the heart, or profuse bleeding into the pericardium, or injury to Kronecker's co-ordination center.

Second.—Those cases surviving for a time and dying either from the loss of blood, or accumulation of blood in the pericardium—heart tamponades.

Third.—Those cases recovering from the injury and loss of blood, but in whom the cicatrix in the heart wall gives way under exertion. In these cases, healing is not restituo ad integrim, but there is produced a weak cicatrix of connective tissue. If there is no sudden exertion this may lead to an aneurism of the heart.

Izzo reported a case of stab wound of the left ventricle which was discharged cured on the twenty-eighth day; a few hours later the patient died suddenly while lifting a heavy boly. At the autopsy the cicatrix of the left ventricle was found ruptured. Nine such cases are recorded. Of the wounds of the heart about 90 per cent. are penetrating and of these only about 19 per cent. are fatal. Of the seventy-five deaths in the operated cases, sixteen occurred on the operating table or within one hour after the operation, and seventeen from seven hours up to two days, which makes a mortality of 44 per cent. from hemorrhage and collapse. Thirty died as a result of infection, or 84 per cent. of the seventy-five deaths in operated cases were due to hemorrhage and infection (Hill). Forty-nine cases recovered, about 40 per cent. of the cases operated. Statistics show a more frequent injury of the left ventricle than of the right although most authors have placed the right first in the order of frequency. As already stated the auricles are seldom penetrated.

Treatment.—In these cases immediate operative

interference is indicated, for according to Rehn not a single death can be attributed to the operation. One must approach such a case with the knowledge that the conditions are desperate and that death on the operating table has occurred in a large proportion of cases. All authors state that a needle penetrating the heart should be removed at once, but that a knife blade, or similar instrument, should never be withdrawn until the surgeon is fully prepared to deal with the wound in the heart itself. If the condition of the patient will permit, thorough aseptic preparation should be made, for as has already been shown, a large proportion of cases die of sepsis, either of the pericardium or pleura. During the period of preparation mechanical pressure on the heart may be diminished by aspiration of the pericardium. For this it is recommended that the needle be passed through the sixth left interspace close to the sternal margin for one-third inch, then behind the sternum for half an inch, to escape the pleura, and then raising the handle push the needle downwards into the pericardial sac traveling a little more than two inches (Hill). The use of an anesthetic depends on the condition of the patient; if unconscious no anesthetic need be employed, but where the patient is conscious chloroform is generally recommended. The use of the local anesthetics or of morphin combinations would hardly be of use in these cases.

The generally accepted incision is that of Professor Rotter, of Vienna. An incision four inches in length is carried along the lower border of the third rib, commencing three-fifths of an inch from the sternum—then downwards to the lower border of the fifth rib and along this inwards to a point three-fifths of an inch from the sternum. The fourth and fifth ribs are divided and the musculo-osseous flaps turned upward. The incision must not approach nearer the sternum for fear of injury to the internal mammary artery. This incision gives opportunity to inspect both the pericardial and pleura cavities and the heart and to remove any extravasated blood. In all about fifteen methods of incision have been suggested, and are divided into the transpleural and extrapleural. The extrapleural is only of advantage in the small proportion of cases in which the pleura is not opened and has the great disadvantage of a small opening and limited field of operation. Rehn advocates incision of the pleura, when it is not injured, to avoid negative pressure from aspirating air into the mediastinum, causing the blood to foam.

Formestraux and Line[8] recommended the following incison: "A cutaneous-muscular flap is formed and thrown outwards; the flap includes the skin and the great pectoral. The advantage of turning the flap outwards is that the external surface of the thorax can be examined, and it can be seen if the wound is a penetrating one or not. The flap is covered with a compress, and the third, fourth and fifth ribs are resected 8 cms. from the sternal border; the ribs are divided with a costotome or a strong chisel. The intercostals, as a rule, do not bleed, and if they do, the hemorrhage is soon stopped. The flap is turned inwards, and the parietal layer of the pleura is turned inwards with it. The only objection is that the pleural cavity is opened, but the operation can be done more quickly this way. Very often the pleural cavity is opened by the same weapon which has wounded the heart, and the authors have never seen any severe symptoms which they could refer to opening of the pleural cavity."

The wound of the lung, when one exists, as a rule, ceases to bleed as soon as the lung collapses.

The opening of the pericardium is enlarged by cutting or tearing in the axis of the heart. On exposing the heart if profuse bleeding is taking place this may usually be checked by placing the finger in the wound until suture can be inserted. A round curved intestinal needle is recommended. Silk has been more generally employed but catgut has also been used in a number of successful cases. The sutures are inserted at intervals of about one-eighth of an inch; they should not penetrate the endocardium, the ends cut rather long to prevent untwisting and should be tied during diastole, if possible, although Stewart claims this is not necessary. The following quotation from Hill fully explains the method of suture:

"With the right hand gently lift the heart out of the pericardium and introduce, from below, the left hand, and immediately we feel the vena cava inferior, and its inosculation into the right atrium, which should be pressed between the index and ring finger, and pushing upwards we displace the inosculation of the vena cava superior. Rehn truthfully remarks "we have in the compression of the right atrium venosum a means of bringing the most violent heart bleeding to a stop at once." In suturing be certain to get a good hold, do not include the endocardium, lest a brittle heart give way. I prefer the interrupted catgut stitch and to use an intestinal needle. Should the heart appear weary, allow it to glide back to its normal position for a few moments. As few stitches as possible should be passed, commensurate with safety against leakage, as they cause a degeneration of the muscular fiber

with its tendency to dilatation and rupture. Giordano, from his experiments upon rabbits, prefers Lembert's sutures in closing an auricular wound. The sutures should be passed and tied during diastole."

Should the heart cease to beat during the manipulations, the sutures should be rapidly passed and then the heart massaged.

Conclusions.—Having no practical experience in these cases I can do no better than quote the conclusions of Hill in his paper published September 19, 1908, in the *Medical Record.*

1.—That any operation which reduces the mortality of a given injury from 90 to 60 per cent. is entitled to a permanent place in surgery, and that every wound of the heart should be operated upon immediately.

2.—Whenever the location of the external wound and the attending symptoms cause suspicion of a wound of the heart, it is the duty of the surgeon to determine the nature of the injury by an explanatory operation.

3.—Unless the patient is unconscious, and corneal reflex abolished, as in Pagenstecher's case, an anesthetic should be given, and preferably chloroform. Struggling is liable to produce a detachment of a clot, and renew the hemorrhage, as occurred in Parlavecchio's patient.

4.—Never probe the wound, as serious injury may be inflicted upon the myocardium.

5.—Rotter's operation renders access to the heart extremely easy, gives an opportunity of removing any extravasation of blood, and inspection of the pleural cavity with reference to the injuries.

6.—Steady the heart before attempting to suture it either by carrying the hand under the organ and lifting it up, or if the hole is large enough, introduce the little finger, as Parrozzani did, which will serve the double purpose of stopping the bleeding and facilitate the passage of the stitches.

7.—When the hemorrhage is so profuse as to preclude the possibility of suturing, with the right hand gently lift the heart out of the pericardium and introduce from below the left hand and press between the index and ring finger the vena cava inferior and its inosculation into the right atrium, and pressing upwards displace the inosculation of the vena cava superior.

8.—Professor Magnus, of Heidelberg, believes that the heart will stand complete compression for a minute and a half and incomplete for four minutes.

9.—Catgut sutures should be used, as wounds of the heart heal in a remarkably short time. The sutures should be interrupted, introduced, and tied during diastole, not involve the endocarium, and as few as possible should be passed commensurate with safety against leakage, as they cause a degeneration of the muscular fiber with its tendency to dilatation and rupture.

10.—In cleansing the pericardium, it should be sponged out and no fluid poured into the sac, as quickly produced tension may cause serious consequences to an already disabled heart.

11.—Until every aseptic precaution has been taken the mechanical stoppage of the heart from accumulation of blood in the pericardium should be prevented by aspiration, as diminished resistance from loss of blood and want of cleanliness from hurry of preparation are largely contributive causes to the 40 per cent. of deaths from infection.

12.—Rehn suggests closing the pleura and draining the pericardial sac, but never the reverse, because of the ease of infection of the pleura, which may extend to the pericardial wound and cause the formation of pus in the closed pericardium.

13.—For drainage, tubes are preferable to gauze, as the latter is liable to cause retention of the discharge and may strangulate the heart.

14.—A needle may be removed at once, but a knife blade must not be touched until the surgeon has bared the heart and is master of the situation, as an uncontrollable hemorrhage might occur from premature extraction.

Besides operations for injuries it has been proposed to operate on some forms of heart disease. Experimental pericardiectomy has been carried on by Parlavecchio to determine its therapeutic value, and possible application.

A number of cases are on record of congenital absence of the pericardium, and in most of these, which he summarizes, there were no disturbances calling attention to its absence, which was an autopsy surprise. There were circulatory disturbances in a few, but the prognosis of this defect seems to be good when the thoracic organs are normal. Experiments on ten dogs showed that pericardiectomy is an operation on about the same plane as splenectomy or partial thyroidectomy. It should be regarded only as a last resort, but under these conditions it has good prospects of success. Broad resection of the pericardium may, therefore, be considered in cancer of the adjoining organs or in chronic pericarditis resisting conservative measures. The pericardiectomy would leave a defect which might favor infection of the pleura, but pleurisy is much easier to cure than pericarditis, and it is the lesser of two evils. The Rydegier

technic gives ample access. He does not try to avoid sacrificing the left phrenic nerve, having found that the functions of the diaphragm do not suffer by its removal, while its retention might result in dangerous adhesion of the nerve to the heart. The technic should be dominated by the necessity of avoiding injury of the auricles and large vessels and to refrain from touching the right wall of the pericardium, for fear of injuring the phrenic nerve or the other pleura, which would be liable to entail paralysis of the diaphragm or bilateral pneumothorax. In none of his dogs were the adhesions after pericardiectomy very calamitous. The fewest adhesions were found in dogs with more extensive resection. Some of the dogs are in apparent good health to date, five or six months since the operation, although all grew thin at first and the left venricle became hypertrophied.

Morison (*Lancet,* July 4, 1908) refers to the possible operative treatment of *corbovinum.* In this condition he believes that it is the bulk of the heart and the force of the cystole which are the determining factors in the situation and that operation to afford room adequate for the free action of the enlarged organ was the primary consideration whether the organ itself was tethered or not. With a large heart, powerfully pulsating against hard and resistant structures, he asks, what is more natural than that the striking and indirectly struck organ should from time to time develop a condition of excitation or erethism in excess of what is normal to it, and that such erethism should be associated with increased systolic pressure, augmented by mental causes due to subjective discomfort in various degree, from uneasiness to pain.

Morison describes the case of a youth of 19 who had exaggerated aortic valvular disease, severe attacks of retrosternal pain, accompanied by quickening of pulse and heart beat and rise of systolic blood pressure, these phenomena subsiding with the pain. The cardiac action was heaving and concussive, the heart enlarged, and thrusting, not simply against a soft interspace, but against an unyielding rib. A condition of erethism was thus induced, leading to the attacks. Four and a half inches of the fifth rib and five and a half of the sixth were removed. The effect of the operation objectively and subjectively has been very satisfactory. The carotid and suprasternal pulsation is less marked, the chest capacity is increased, the painful attacks have almost disappeared, and when present are much less severe.

Chronic Valvular Lesions.—Cushing and Branch, acting on a suggestion of Sir Lauder Brunton that it might be possible to relieve mitral stenosis by surgical measures, have succeeded in obtaining operative recoveries after a considerable number and variety of experimental valvular lesions in dogs made by a direct approach to the valve through the heart wall. "It remains to demonstrate the possibility that an experimentally produced mitral stenosis with compensatory failure can be symptomatically improved by division of the narrowed mitral orifice on the living animal, before attempting by a similar procedure to relieve the corresponding pathologic lesion in man."

Heart Massage as a Means of Stimulating Respiration.—T. A. Green (*Lancet* of December 22, 1907) believes that in suitable cases heart massage is of decided value to the practical surgeon. The kinds of cases in which it may be used with a fair prospect of success are:

(1) Cases of primary arrest of the heart in a condition of acute dilatation from poisoning by an overdose of a powerful volatile drug, such as chloroform; (2) cases where the gradual accumulation of volatile poisons, such as chloroform, leads to primary paralysis of the respiratory and vasomotor centers followed by stoppage of the heart; (3) cases of asphyxia, and (4) cases of suspension of the functions of the vital centers from simple exhaustion or injury, and consequent stoppage of the heart.

The order of procedure in these cases of sudden heart and respiratory failure should be as follows:

1.—Immediate lowering of the head and the commencement of artificial respiration and tongue traction, taking care that a free access of air to the lungs is possible, and therefore implying tracheotomy if necessary.

2.—If the abdomen is open, pressure on the abdominal aorta to confine the circulation to the upper part of the body. If it is not open the intravenous injection of adrenalin solution and the application of Crile's rubber suit or, failing this, tight bandaging of the limbs and abdomen.

3.—The subcutaneous or intravenous injection of normal saline solution, partly to raise the blood pressure, and partly to dilute any poisons which may be in the blood and tissues.

4.—If the above methods have not been successful after being applied for from eight to ten minutes heart massage by the subdiaphragmatic method. This route should always be adopted, unless the chest is already opened or to be operated upon, as

being the easiest way of access, the one fraught with least danger to the patient and the one which has given the greatest percentages of success. The time is fixed at from eight to ten minutes because eight minutes is the limit of the interval at which up to the present time a complete success has been obtained in man, and if it is exceeded the danger of the production of fibrillary twitchings, inability to restore consciousness, and the development of spasms in the voluntary muscles with consequent failure of the manipulations have to be taken into consideration. The unavoidable extension of this limit, should, however, be no bar to the adoption of the method, as very hopeful results have been obtained, even when forty-five minutes have elapsed from the onset of the syncope before it has been tried.

5.—After normal pulsation has returned to the heart, artificial respiration must be continued until spontaneous breathing has been restored or until circumstances make it improbable that such restoration will be obtained.

Resuscitation by Heart Massage. C. S. White, (*Maryland Medical Journal,* September, 1908), reports the case of a boy of twelve in whom life seemed extinct after chloroform administration, notwithstanding the application of the Trendelenburg position and artificial respiration by the Laborde and Sylvester methods. The abdomen was opened from the ensiform cartilage to the umbilicus and compression of the heart through the diaphragm with the right hand, about twenty-five times a minute, was practiced, the left hand being on the thorax over the heart. After about seven minutes the apex beat was distinct. The operation was completed at 1 P. M. The patient had convulsions at 2, 3 and 5 P. M. He died at 9 A. M., twenty hours after resuscitation. This makes the fourth reported case.

Effusions into the pericardium may be dealt with surgically with success, and it is probable that many more cases should be subjected to peracentesis of the pericardium than have been in the past.

Frequency of pericarditis, as shown by autopsy statistics varies very much, fourteen cases in two hundred and seventy-five autopsies made by Anders and forty cases in four hundred and fifty-two autopsies at the Pennsylvania Hospital, as reported by J. A. Scott. In the forty cases reported by Scott sixteen, or 40 per cent. were purulent in character. As an etiological factor pneumonia predominated, being the primary disease in twenty-two cases. In all these cases pleurisy also existed.

In seventy-six autopsies of patients dying with croupous pneumonia thirty-eight, or 50 per cent. pericarditis was found, and in seventeen of these the pericardium contained a purulent exudate.

Besides pneumonia purulent pericarditis is found in conjunction with empyema, abscess near the pericardium, cancer or ulcer of the esophagus and in pyemic conditions generally. The diagnosis of this condition is generally quite difficult because of the fact that this is a complicating condition and the patients are usually seriously ill with the primary disease before the appearance of the pyopericarditis.

I will not take up your time with a description of the symptoms or physical signs, for they are to be found in the text-books generally. I would, however, direct your attention to the necessity of a careful examination of the chest for this condition, in patients seriously ill who complain of pain or fulness about the heart. Before fluid is extravasated there may be friction sounds, later these disappear, the area of cardiac dulness becomes increased and apex either becomes elevated or may disappear. Where this condition is suspected there should be no hesitancy in inserting a needle into the fourth or fifth space near the left of the sternum.

Surgical Considerations.—Exploratory puncture should be made as freely when purulent pericarditis is suspected as it is made in cases of suspected empyema. The presence of pus should be determined in this manner before operating, and can usually be demonstrated by the use of a hypodermatic needle a little longer than is ordinarily used. The dangers during puncture are wound of the heart or large blood vessels and possibility of infecting the pleura, but these are mostly theoretical.

The point of election for puncture is in the fourth or fifth interspace close to the left edge of the sternum. Dock points out that in pericardial effusions the position of the heart is anterior, floating on the fluid, and not far from, and perhaps adherent to the chest in front. If the result of the puncture is negative the posture of the patient should be changed or the site of the puncture shifted. In most cases the necessary incision can be made under local anesthesia and this is usually desirable because of the condition of the patient. Operation may be made either through an intercostal space or with excision of a portion of a costal cartilage.

The point of election for incision, according to R. G. Le Conte, is the fourth left interspace. beginning one inch from the sternal border and extending to the normal position of the apex of the heart, about one inch internal to the anterior mammary line. The tissues are infiltrated with Schleich's fluid

and the incision gradually deepened. When the pleura is adherent it cannot be recognized; but if its cavity is free, and the incision has been carefully deepened, air will rush in as soon as it is penetrated and before the pericardium has been opened. When pus is reached it is allowed to flow out slowly for fear of embarrassing the heart by the sudden relief of pressure. A rubber drainage tube is inserted and an ample dressing of gauze applied. This is sufficient for the time being, and the question of flushing the pericardium or resecting the costal cartilages may be put off until the physical signs show that the drainage is not good or that the tube is plugged with membranous lymph.

Intercostal incision produces no shock; it is the simplest procedure in grave cases; it permits a more extensive operation at a later period if found efficient; it permits the recognition of non-adherent pleural surfaces before the pericardium is opened, and in the majority of cases it will lead to a cure where a recovery is possible from an operative procedure. The question of the recovery of the patient is more dependent upon the cause of the pyothorax and the pathological lesions present in other portions of the body than upon the choice of an operative procedure.

In his valuable paper on this subject, Le Conte offers the following conclusions:

1. Purulent pericarditis is quite frequently overlooked in lobar pneumonia and in other pyemic states.

2. Its presence modifies the pre-existing disease to a considerable extent.

3. In diseases with high temperature the presence of purulent pericarditis depresses the fever range and increases the respiratory and pulse rate without sufficient clinical evidence of trouble elsewhere than in the pericardium.

4. It is yet to be proved that the heart, in case effusion is present in the pericardium, is always dislocated backward and upward. It is probable that in some cases the presence of fluid in the pericardium dislocates the heart either to the right or to the left. (This, of course, will occur if previous adhesion between the heart and the pericardium has occurred on either the right or the left side.)

5. The diagnosis once made, the only treatment should be incision and thorough drainage. (Paracentesis will at times relieve temporary urgent symptoms and should be performed without the slightest fear.)

6. That exploratory puncture can be made with safety and is essential for diagnostic purposes before operation is undertaken.

7. That such puncture should be made in the fourth or fifth left intercostal space, as close to the sternum as possible, with a fine needle.

8. That pericardial dilatation does not alter the relations of the pleura to the anterior thoracic wall.

9. In the presence of pyopericarditis the overlying pleural space is usually obliterated by extension of the inflammation.

10. That incision under local anesthesia is the preferable operation in the majority of cases.

11. That Roberts' chondroplastic flap is preferable to an ordinary excision of costal cartilages when incision fails to give adequate drainage.

73 EIGHTH AVENUE.

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1. Stewart, *Transactions Philadelphia College of Physicians and Surgeons.*
2. *Archives für Klinische Chirurgie,* 83, 723.
3. *Münchner Medizinische Wochenschrift,* September 30, 1907.
4. *Archives für Klinische Chirurgie.*
5. *Archives für Klinische Chirurgie,* Berlin, lxxxiv., No. 4.
6. *Deutsche Medizinische Wochenschrift,* Berlin, xxxiii., September 19, 1908.
7. *Deutsche Medizinische Wochenschrift,* March 2, 1908.
8. *Gazette des Hôpitaux,* March 29, 1906.
9. *British Medical Journal,* January 12, 1907.

RECTAL ANESTHESIA.

It is not intended for abdominal work within the peritoneum.

It is not intended for rectal work.

It is not desirable for long-continued vaginal work.

It is intended for operation about the head and neck, breast, and surface of the body.

It is a boon to operators in thyroid, mouth, throat, and any work where the anesthetizer is in the way. —C. F. DENNY and L. S. ROBINSON in *The Journal of the Minnesota State Medical Association.*

ANNOUNCEMENT.

Publication of Prof. William K. Simpson's article, "A Case of Laryngeal Stenosis in the Adult, Successfully Treated by Intubation," announced for this issue will have to be postponed until the April number.

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WALTER M. BRICKNER, M.D., Editor

NEW YORK, MARCH, 1909.

LILIENTHAL'S METHOD OF CLOSING THE DIVIDED BOWEL.

Intestinal surgery has passed through a more or less stormy period of experimentation, during which various mechanical devices and almost innumerable suture plans for securing bowel union, have been tried and, most of them, ultimately rejected. At present most of the fairly accepted methods of intestinal closure involve a relatively simple, though precise technic of suture. In all the measures tried, both for anastomosis and for sealing up an open bowel-end, complete contact of peritoneal surfaces has always been considered a *sine qua non*.

In the method described by Howard Lilienthal (as a preliminary communication) in this issue of the AMERICAN JOURNAL OF SURGERY, our preconceived notions are violently disturbed. Deliberate peritoneal apposition is not essential to the definite closure of a sectional bowel. Lilienthal has shown this on several human subjects by no less startling a procedure than the simple application of a crushing ligature, and phenolization of the distal mucosa.

It has been amply demonstrated that the application of a crushing ligature and cauterization of the exposed mucosa is an eminently safe and satisfactory method of dealing with the appendix stump. That the same method could be safely applied to the bowel itself has, we believe, not heretofore been conceived. As much as the boldness of the procedure, we admire the boldness of the surgeon who had the courage to try this at once on the human subject!

We shall await with interest the result of animal observations for the answer to many questions anent this new operation, which at once suggest themselves: What is the exact process of healing? Is there a clean stump, or is closure by means of an exudate? How extensive may such an exudate be? Are adhesions formed? (With the appendix, a smooth stump results, with less likelihood of adhesions than after inversion and suture.) What rôle, after all, does the peritoneum play in the final healing, when the ligature has "cut through"? (That a complete circumference of peritoneum is not essential is shown by the successful application of the ligature to the duodenum in pylorectomy). Can the same procedure be applied to the urinary bladder? That question is perhaps only academic, but comparative observations on extra- and intra-peritoneal portions of the bladder may solve the preceding question. What rôle, aside from sterilization, is played by the phenol? Are the chemical lysis and shrinkage of the stump essential to success? What becomes of this stump? (In one of Lilienthal's cases it was discharged.) Is it more often absorbed, as the appendix stump seems to be; or does it become buried in an exudate? What are the dangers of the operation? Was Lilienthal's single fatality the result, as he thinks, of faulty technic; or does it represent an inherent percentage of risk?—W. M. B.

THE MODERN VIEW OF THE TREATMENT OF FRACTURES.

There are a few procedures in surgery in which all surgeons are agreed, and which seem to have reached a state of perfection in which no further improvements seem possible or even desirable. The treatment of fractures is one of the oldest branches of surgical therapy, and it remains still in a changing state, and still associated with differences of opinion, good, bad and indifferent results, and incriminations. Multiplicity of methods in any branch of surgery means multiplicity of unsatisfactory results. When surgeons begin to agree and unite upon certain procedures, that means that satisfactory results are being secured.

Since the introduction of *x*-ray examinations the treatment of fractures has made more progress than it has in any one hundred years before that time. Two important things have been learned. One is, that in the ordinary fracture of the long bones, in a large percentage of cases, the replacing of the fragments into perfect apposition is impossible; and the other is, that we have led the public

to believe that a fracture has not been treated properly unless the reposition is perfect. In fractures of the shaft of the humerus, femur and tibia, particularly, perfect reposition is very commonly not secured. We did not know this until the *x*-ray showed it. Good solid union had been secured, and restoration of function resulted; and it was assumed that the bones had been put back into normal position. Often it was lost sight of that the "rheumatism," neuralgia, eczema, edema, flat-foot, muscular weakness, etc., had any connection with an imperfectly reduced fracture of a long bone of the arm or leg which was solidly united and apparently of normal contour.

Now we know that palpation and measurements are not all sufficient to determine perfect reposition. Overriding and lateral displacement and even angular displacement may escape the most discerning eye. In many cases these conditions cannot be overcome without operation, and in most cases operation, with its additional traumatism, would do more harm than good. We must, therefore, be satisfied to secure union in a not absoluely perfect position, in many cases. This is easily proved after a fracture of these bones has been put up apparently to the satisfaction of the surgeon, by making an *x*-ray examination and observing how often defects of apposition are present. Happily the majority of such cases give a satisfactory functional result.

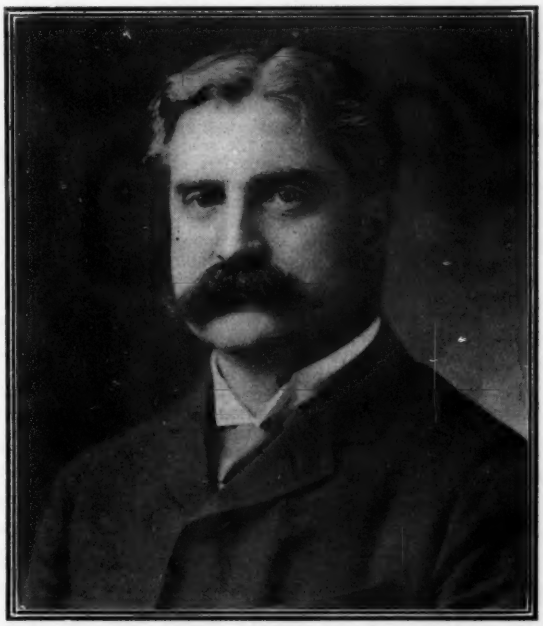
But now we come to the layman's point of view. He thinks of a bone as a stick or rod. When it is broken, he naturally wants the pieces put back in place: that is what he would expect a carpenter to do; and he expects the surgeon to do the same thing. Unfortunately the surgeon has led him to think that is what he can do. When a patient secures a useful limb after a fracture, we have permitted him to think that the fragments were replaced into accurate apposition. Now, if he should see an *x*-ray picture of his fragments, he might be fearful lest the result should be poor. A jury is easily misled by these pictures. It behooves the surgeon to teach the public that the reduction of a fracture is not an easy operation. Joining a broken stick is a simple thing because it is accessible to sight and touch; but a fracture may be compared to a stick surrounded by a mass of elastic bands. all attached to it and pulling in several directions, and which can neither be seen nor felt.

When we have put the public mind straight on this matter, there will be fewer incriminations and fewer suits for malpractice. When we secure a good result, let us not promulgate the notion that we have put the fragments back exactly where they belong unless we can prove it by the *x*-ray; but, instead, let us be contented with the assumption that we have done the best that we could.—J. P. W.

WILLIAM T. BULL.

William Tillinghast Bull, at the age of sixty, died on February 22nd, of a carcinomatous growth of the neck.

As a young man he did epochal work in the surgery of gunshot wounds of the intestines. This, especially, attracted attention to his ability. It brought to him opportunities that eventuated in the eminent teaching position which, in association



with those other masters of surgery, Robert F. Weir and Charles McBurney, he occupied for many years at the New York College of Physicians and Surgeons. His important contributions to appendicitis, hernia, and many other subjects, clinical and operative, are too well known to need repeating here.

His unfailing consideration of his colleagues and his modest estimate of his own services, won for him a remarkable following in the profession and among the laiety, and he was still very active in his practice when his recent illness overtook him.

The loss of Bull, the eminent surgeon and inspiring teacher, is great indeed. But Bull, the man, Bull, the prince of colleagues, will be mourned, and his memory will be cherished until his last patient, his last associate, shall have joined him in the great army of the dead.

Book Reviews.

Medecine Operatoire des Voies Urinaires. Anatomie normale et Anatomie pathologique chirurgicale. Par J. ALBARRAN. Large octavo; 991 pages; 561 illustrations. Paris: MASSON ET CIE., 1909.

Whereas we deplore the lack of good American books on diseases of the genito-urinary system, we cannot but greet with pleasure this accession to urology in the form of a foreign book well worth the consideration of both the specialist and general surgeon. Coming from the pen of Albarran, the most eminent of Guyon's pupils, the volume necessarily embodies much of what is authoritative in the French school, and as such must be welcomed.

In his preface, the author states that he purposes to write a work on operative surgery of the urinary tract, clearly signifying his intention, however, to omit everything but that which, in his own experience, has been found best and most useful. It is this feature which—inasmuch as it is closely adhered to—makes the book of inestimable value, for in its present form it must be regarded as an exposition of the most modern views held by at least one school of French urologists.

In a compass of 991 pages, the author discusses the operative procedures done on the kidneys, ureters, bladder, prostate and urethra, dividing the subject matter into five distinct parts. Especial attention is given to anatomical considerations; these are presented in such a thorough scholarly fashion and are so admirably illustrated by photographs, line drawings and half-tone reproductions bearing upon the relations of the various structures encountered in operating and upon topography, that one cannot but feel that, in this particular, the author has added a feature of no mean worth. Throughout the anatomical sections the text is replete with allusions to the surgical importance of the various morphologic details, the practical viewpoint always remaining prominent.

As for the treatment of the operative procedures, we can recall but one book, namely, Légars's "Imperative Surgery," in which the description of technic is set forth in so interesting a manner. In perusing these portions we are always kept alive with feeling that we are dealing with a patient whose condition demands this or that surgical intervention. And so the subject of nephrectomy is discussed, not in a general way, but separately for the various conditions requiring it; 3 pages are devoted to nephrectomy demanded by trauma, 3 pages to hydronephrosis, 6 to pyonephrosis, 14 to tuberculosis, 26 to neoplasms, etc.

The preparation of the patient, the after-treatment and the complications are matters which have not been neglected, and the paragraphs devoted to these will surelv be of value to those surgeons whose experience in this field has not been as wide as that of the author.

As an example of book-making, the volume does credit to the well-known firm of Masson and Company. It, too (as well as some of the German books that have recently appeared), bears the stamp of modernism that first emanated from American publishers. The illustrations are excellent.

Although we have already been sufficiently profuse in our laudations, we cannot close without expressing the hope that the volume will serve as an example to the profession of this country, and that it will find a permanent place in the library of every American surgeon.

New York Charities Directory. An authoritative classified and descriptive Directory to the philanthropic, educational and religious resources of the City of New York. Compiled by H. R. HURD. *Eighteenth edition.* Duodecimo; 813 pages. New York: THE CHARITY ORGANIZATION SOCIETY, 1909. Price, $1.00.

The benevolent activities of New York City—private and municipal—are so numerous and so diversified that this directory is a necessity to its charity workers. To those also, who are studying, in New York, hospital, settlement, relief or any other of the numerous sociologic problems, it will be of distinct service.

Atlas und Grundriss der topographischen und angewandten Anatomie. (Lehmann's Medizinische Atlanten, 1 Band.) Von DR. MED. OSKAR SCHULTZE, Professor der Anatomie in Würzburg. Zweite vermehrte Auflage. Large octavo; 224 pages; 22 multicolored plates and 205 illustrations, also mostly in color, from originals by the artists A. Schmitson and K. Hajek. München: J. F. LEHMANN, 1909.

Of the first edition of this beautiful atlas and text-book of topographic and applied anatomy, an English edition was prepared by Professor George Stewart in 1905, and the work is no doubt a fairly familiar one to American surgeons and students.

In this second edition Professor Schultze has introduced 115 new illustrations, many of them multicolored, most of them reproduced from paintings by K. Hajek. The text has also been enlarged, but not proportionately. The remarks on applied anatomy are not, as in the first edition, interwoven with the topographic anatomy in the text, but are separate, as an appendix, under each anatomical division.

This atlas must be seen to be appreciated.

Precis de Pathologie Chirurgicale. Tome I; Pathologie Chirurgicale générale, maladies générales des tissus crâne et rachis. Par P. LECÈNE, Professeur agrégé à la Faculte de Paris; R. PROUST, Professeur agrégé à la Faculté de Paris; et L. TIXIER, Professeur agrégé à la Faculté de Lyon. Tome II; Tête, cou, thorax. Par H. BOURGEOIS, Oto-rhino-laryngologiste des hôpitaux de Paris, et CH. LENORMANT, Professeur agrégé à la Faculté de Paris. Small octavo; Volume I, 1,028 pages; Volume II, 984 pages; illustrated. Paris: MASSON ET CIE., 1909.

These are the first two of a series of four volumes in which practically the whole subject matter of surgery, with the exception of operative procedures, is to be discussed in a concise manner. The first volume includes general surgical pathology, surgical infections and the diseases of the brain, cranium, spinal cord and vertebral column. In the second compendium, the rest of affections of the head, and those of the neck and thorax are treated.

It is unfortunate that the well-known authors have not evidenced a wider recognition of the more recent work on pathology. Throughout the work the tendency to adhere to much that is classic and of French origin, is manifest. However, in spite of this, there is much deserving of commendation. The student of surgery will find these compends of great value in the exposition of those conditions that are but infrequently met with in our own hospitals. Thus the matter of syphilis of the joints and bones, the inflammatory diseases of muscles, the affections of salivary glands, these and many others are admirably presented. The sections on diagnosis are excellent. Here as in other French text-books, the masterly influence of Duplay is reflected by his pupils.

We can heartily recommend the work to those American students who wish to possess a handy reference book that will be serviceable both in the rapid review of a subject and in clearing up their conceptions of many doubtful and rare affections.

Obstetric and Gynecologic Nursing. By EDWARD P. DAVIS, A.M., M.D., Professor of Obstetrics in the Jefferson Medical College, Philadelphia; Obstetrician to the Jefferson Hospital; Obstetrician and Gynecologist to the Philadelphia Hospital. *Third edition.* Octavo; 436 pages; 90 illustrations. Philadelphia and London: W. B. SAUNDERS COMPANY, 1908.

This book, considerably enlarged in this edition, is a comprehensive work, within its scope, and thorough even in the elementary details. Part 1, on The Nursing of Obstetric Cases, embraces the anatomy and physiology of pregnancy, nursing in normal and complicated cases, and the care of infants. Part 2, Gynecologic Nursing, makes interesting reading, and is likewise exact in detail. An appendix on Dietary and the preparation of surgical supplies makes a good conclusion to the volume.

The undergraduate nurse, especially, will find this a helpful manual.